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Hydro-Electric Practice

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Precipitation and Run-Off.

IN THE evolutions of civilization two purposes have steafastly been kept to the fore, economic production and lavish consumption; nowhere is this more emphasized than in our own country, and of no other specific development is this more true than of power application. In fact the strides of mankind made during the last semicentury are to be credited chiefly to the mastery of power agencies which has substituted the machine for the man, the engine for the animal, has annihilated space and time and now yields to the efforts of one generation results and accomplishments never dreamed of by all who preceded it.

The peoples of the earth have come to fully realize this potent influence of power utilization on every phase of human endeavor and undertakings and, in the light of this revelation, the civilized nations of the world are even now studying means and methods and are putting into action policies which best promise to secure to them the most economic and fullest future enjoyment of nature's power resources.

King coal had nigh rung the death knell of the oldest known and utilized source of energy, water power, when the advent of a new rival revolutionized the world's power regimen; transmissible electric energy made its debut upon the power stage and, joined to the old and almost dethroned potentate, the union of hydro-electric power now holds full sway.

But the world has reason to remember the former reign with gratitude, nor is it ready to dispense altogether with its beneficent rule, but its glory is on the wane, and even now we are counting the years during which we may be permitted to yet enjoy it. Yes, "the mill will ever run with the water that has past" is the nowaday version of the one poetical negation of this truth which is the everlasting foundation to the future supremacy of the hydro over the coal-power source; as long as the oceans prevail will hydropower be vouchsafed to mankind.

The economic utilization of the water power is then the present goal, for attaining this renders its liberal application most feasible while it yields, only then, the rewards which are within its gift. This is to be the topic of a series of articles contributed by the author to Municipal Engineering which will be treated in the logical analytical sequence from inception to utilization.

Determining the commercial value of a hydro-electric opportunity should be, and now generally is, the first move in the enterprise. It is followed by the designing and construction of the works, while the desired purpose is finally realized by operation and maintenance of the plant. The most economical utilization of the power source can be secured only if each of these three is executed with thoroughness guided by correct judgment. No industrial undertaking may hope to be successful if it is conceived in error, if the fundamental conditions are misjudged or not explicitly understood. In some lines this is not altogether feasible, speculation of more or less degree can be avoided in the formulation of original plans, which are only cleared by future experience. Hydro-electric enterprises need not be so handicapped, as they can be analyzed with remarkable accuracy. The object is to manufacture a product of uniform quality and fixed quantity, electric energy, and the process utilizes one class of raw material of uniform character, the hydro-power sources, the available volume of which may be determined with accuracy at the outset. Few other enterprises are founded on

such simple conditions. But it is the very simplicity which is the cause of many disappointments in hydro-electric developments, leading first to a dangerous underestimating of the needed care and caution in launching the project and later on to a development which, being conceived in ignorance of the true conditions, is destined to prove a financial failure.

The available power source, the potential flow and fall, can and should be determined with precision. There is no warrant for a hydro-electric plant to experience an abnormal deficiency of flow or fall from that on which the development is based. Where this is the case, the original analysis was in error or the true conditions were knowingly set aside in planning the development.

All the water resources, surface and underground, in the temperate and tropic zones, are due to precipitation, which originates almost wholly from the oceans. The annual precipitation volume varies considerably in a given catchment basin, not because the vaporization of ocean waters differs materially from year to year, but by reason of its ever changing destination as precipitation, which is wholly under the influence of air currents and temperature. Therefore it is true that present normal precipitation is no less nor more than what it has been in the past, and the assumption is likewise warranted that it is not likely to diminish in the future. Our knowledge of precipitation volumes in this country dates practically from the periods of settlements of the different sections, not only as of hearsay and recollections but from recorded measurements at principal points, which system has been gradually perfected so that at the present time the daily precipitation conditions in all sections, and in every river's drainage area, are accurately known.

The normal annual volume in this country varies in different sections from ten to one hundred inches. It is highest on the Atlantic, Gulf and Northern Pacific coasts and grows less inland, being lowest in the east of the Rockies region, that of the Great Basin, so called. On the Washington coast is the point of greatest rainfall, the annual normal exceeding one hundred inches, which is a localized condition due to the near approach of the warm Japanese current. Southerly on the Pacific coast it rapidly decreases, being sixty around Portland, fifty at San Francisco, thirty at Los Angeles and falling to twenty at the Mexican boundary. The Western foothills of the coast hill ranges mark a uniform precipitation belt of twenty inches, so that the change in Washington is from one hundred to twenty inches in a distance of about one hundred miles from the coast. Easterly, across the continent for about twelve hundred miles between longitudes 100 and 120, lies a broad low-precipitation area, being normally twenty inches at the Canadian and fifteen at the Mexican boundary. This comprises the arid regions covering Montana, the Dakotas, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico, extending north and south into the Canadian Northwest and Mexico with still lessening precipitation, so that extreme precipitation fluctuations may be found in a journey from Seattle through the Province of Athabasca, with one hundred inches and more of rainfall at the former, while in the latter section, at some points, it has not rained during the past two years, though there has been some snowfall. On the Atlantic, Cape Hatteras and the section near Mobile, Ala., mark the highest precipitation areas, with sixty inches, decreasing gradually northerly and westerly to about fifty inches along the thirty-sixth parallel, which marks the north boundary of North Carolina, Tennessee and Arkansas, and to about the same volume at the Mississippi valley, and thence it gradually grows smaller in a northwesterly direction, more rapidly westerly from the Mississippi than from the eastern extremity of the fifty-inch belt, to forty inches along a belt on the general direction of the St. Lawrence River, Lakes Ontario and Erie to the southwest corner of Missouri, and then due south through Oklahoma and Texas. And thus the decrease continues northerly and westerly, the thirty-inch belt passing through Lake Superior and from its western end southwesterly and south about along the ninety-eighth meridian through Nebraska, Kansas, Oklahoma and Texas, while the twenty-inch, as before stated, runs nearly north and south in the proximity of the 100th meridian.

The normal precipitation volumes in the different sections where water power utilization is now or will be an important future asset are for the New England States, 35 to 40 inches; New York, Pennsylvania and Maryland, 40 to 45 inches; Michigan and Wisconsin, 30 to 35 inches; Minnesota, 25 to 30 inches; Iowa, 30 to 35 inches; Illinois, Indiana and Ohio, 35 to 40 inches; Virginia, West Virginia, Kentucky,

Missouri and Arkansas, 40 to 50 inches, and in the remaining Southern States east of the Mississippi, 50 to 55 inches. Those on the Pacific coast have already been detailed, while for eastern Ontario it ranges from 30 to 40 inches and in western Ontario from 20 to 30 inches. Exceptional to these generalized conditions is the high precipitation area, with 65 inches to the southwestern Appalachian range, where Tennessee, the Carolinas and Georgia bound jointly, including Chattanooga and Knoxville, Tenn.

The aggregates of a seven-year cycle are nearly uniform, but in this period the annuals fluctuate greatly. For instance, for a drainage area in Alabama, where the normal precipitation is from 50 to 55 inches, it was in 1903, 59; 1904, 38; 1905, 39; 1906, 56; 1907, 60; 1908, 58; 1909, 59; mean, 52.7 inches; and it is clear at a glance that the investigation for the potential flow must deal with the years 1904 and 1905, as one or more years of such low precipitation are certain to occur and it is not feasible, nor would it be economical, to provide storage or auxiliary power supply to meet the difference in flow value between these and a normal precipitation year. Ordinarily then, one must deal with the dry year conditions and in some cases, as in the one above, the flow in the year following the one of lowest precipitation proved the smallest, because the dry year was preceded by one of abnormally high precipitation, ground storage was plentiful and helped to raise the flow during the dry year, while no such replenishing source was available during the year succeeding the dry.

For the first approximate information as to available potential flow, the evaporation rule may be taken. Only a portion of precipitation finds its way into the streams, a large part is absorbed by vegetation and is vaporized from land and water surfaces; some sinks into the ground, whence it feeds gradually into the river, and finally a part runs off the surface while precipitation falls. The first two are charged to evaporation and they represent 50 per cent. and more of the total precipitation. If the dry year's precipitation is 38 inches, about half of this, or 19 inches, may then, for approximate information, be taken as the available run-off. One inch of water on one square mile represents $5280^2/12$ equals 2,323,200 cubic feet, and dividing this by the number of seconds in the year, 365 by 24 by 60 by 60 equals 31,536,000 seconds, the result is the continuous uniform flow of this volume, being 2,323,000/31,536,000 equals 0.073 cubic second-feet. For 19 inches it becomes 19 by 0.073 equals 1.387 c. s. f. and for a drainage area of 1,000 square miles the annual flow would be 1,387 cubic second-feet. This is the total for the year, and were it uniformly distributed by nature or artificial conserving, it would represent the potential flow. This, however, is not feasible. There may be months during the year when precipitation will be only a small fraction of the twelfth part of the annual thirty-eight inches. There may be two and more months in succession of such condition. Furthermore, it is a fact that evaporation is not uniformly distributed throughout the year but that it is low in the winter, spring and fall and high in the summer months. During the period from June to November evaporation is nearly three times as great as during that from December to May. The former is the growing, the latter the replenishing period, and unless precipitation distribution is in ratio of these evaporation variations, it will be readily understood that the monthly run-off may fluctuate extremely. And finally, the daily flow variations play an important part in potential flow determinations. Unless commensurate storage is provided, the storm run-off during and after a heavy rainfall passes down the river in a few days, and thus greatly reduces the available remainder of the annual run-off.

It is therefore true that a daily-flow analysis of the dry year is the only safe basis from which the potential flow can be determined with results of any practical value, and there is no reason why such a daily-flow analysis may not be made nowadays for any water course in the United States which offers a hydro-electric opportunity of commercial importance.

The Park System of Minneapolis, Minn.

By an Editorial Correspondent

Truly unadorned beauty is made the keynote of the extensive park system of Minneapolis. Mr. Wilbur F. Decker, president of the Board of Park Commissioners, in his 1909 report, states in one sentence the past intentions and future plans for beautifying the Minneapolis parks. He says: "While in many park systems the crowning features are artificial, ours are natural, and our improvements should generally be of a subordinate nature."

The work of acquiring park lands has been practically completed, and the territory now embraced in the park system should prove amply sufficient to provide for all future development. As may be noted from the accompanying diagram, the total area of the Minneapolis parks, including both land and water, is 3,369 acres. Of this 1,280 acres is water area, and the value of water in the development of beautiful parks is so well recognized as to need no comment.

A portion of the park system, known as Glenwood Park and the Lake District, is shown in the map here reproduced. This portion is joined to Mississippi Park by a long strip of land running east from a short distance south of Lake Harriet. This makes a continuous parkway so that one may travel on park land from a short distance south of the city hall, down along a beautiful river drive through Minnehaha Park, thence across the city along Minnehaha Parkway Parkway to Lake Harriet and thence along the borders of Lake Calhoun, Lake of the Isles, Cedar Lake and Brownie's Lake to Glenwood Park. This drive is maintained in faultless condition, the roadways being of oiled sand or macadam, with bordering woods in their natural state of wild beauty. Two of the photographs indicate the charm of scenes along this drive. The length of the drive entire is almost thirty-two miles and it begins and terminates in the better residence section of the city.

Mississippi Park extends along the Mississippi River, as its name would imply; a portion on each side of the river and a number of islands being embraced in the park system. The river at this point has in places eaten its way deep into the rock formations, so that portions of the park lie along wooded bluffs; while the skilful placing of the river drive at points allows of a long uninterrupted view of the city as from a mountain top.

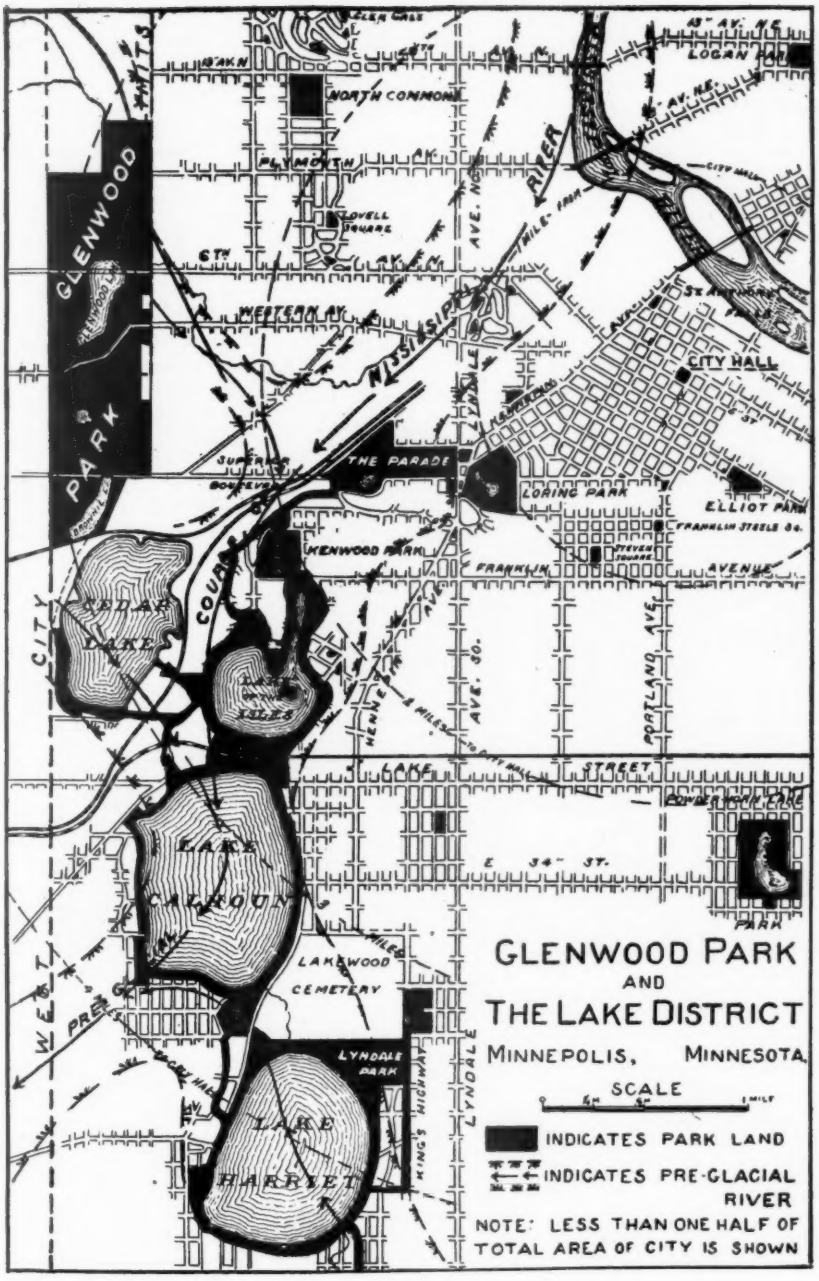
The association of Minnehaha Park with "Laughing Water" makes it perhaps the most attractive park of the system. Rustic bridges, stone steps and occasional stone arches have been added for safety and convenience, but otherwise the tendency has been to avoid all attempt at ornamentation. The long parkway connecting this park to the lake district follows closely along the banks of Minnehaha Creek and many very pretty scenes such as those shown in the second photograph may be noted.

Of the lake district it may be said that more attempts at artificial adornment have been made. Pavilions have been built, where canoes, launches and rowboats may be rented and where refreshments are sold, all under direction of and for the park system. In these buildings the attempt has been made, and in fact accomplished, to make the style of architecture consistent with the natural landscape features. The Lake Harriet pavilion is perhaps the most representative of these. It is a wooden building with a broad pillared portico extending entirely around it. The entire roof of the building is devoted to a roof garden, a band shell occupying the side opposite to the lake.

A more formal treatment of the drives and walks has been observed in the lake district. Here a definite grade has been established, to which the roadways and walks are made to conform, and in many parts curbing has been placed, confining the roadways to regular geometrical curves. Along the borders of the drives of Lake Harriet, single-globe boulevard light standards have been placed, and in addition occasional high-power tungsten lights furnish illumination along the paths.

As very little artificial ornamentation has been necessary throughout the entire system, the park commission has been able to provide for shelter houses, baths, playgrounds, etc. The former are of great value in the enjoyment of the parks during the winter months, as the great water area of the parks makes skating one of the most enjoyable features.

The field house in Camden Park, of



PARK SYSTEM OF MINNEAPOLIS, MINN.

I. Map of Glenwood Park and Lake District.

which a photograph is given, is representative. It was presented by Mr. and Mrs. C. C. Webber during the year 1909. The field house may be considered as divided into three separate parts, the Camden Park swimming pools, the field house (for shelter) and the Camden Park library.

There are two swimming pools, one 60x120 feet in size and from three to four feet deep, and one 45x43 feet and nine feet deep. The depth in both pools can be increased one foot. The pools are fed by the stream passing through them, the flowage being under absolute control through properly arranged spillways and gates. The pools can be emptied in two hours and filled in one hour. They are surrounded by a wide platform, and are enclosed by a wall twelve feet high and with no roof. To the north of the pools are eighty-two double-sized dressing rooms, the office of the attendants, the toilets and shower baths. While the rooms are all roofed the alley-ways are open overhead.

To the south of the main pool and connected with it through a door and tile-roofed porch is the John D. Webber field house, a very attractive and convenient shelter building. The main floor is 53x27 feet in size, and is used as a warming-room during the skating season, for which purposes a checking booth for clothes and skates is provided. In the summer this room will be utilized as a shelter house. Sanitary and modern toilet rooms are connected with this floor. The basement contains a room of the same size, which is so far unassigned. It may, later on, be equipped and utilized for shower baths for winter use. Under the projecting porch and wings of the main building toward Washington avenue are the boiler room and a store-room. Above the shelter room, being a part of the main building, is the Camden Library, a branch of the public library. This is a very handsome room of the same size as the shelter room, conveniently reached from the porch by an easy stairway in the west wing.

PARK SYSTEM OF MINNEAPOLIS, MINN.
II. View on Minnehaha Creek.

The entire set of buildings is of reinforced concrete construction of rough-cast exterior finish, and with a red tile roof. The building is of the Spanish Mission style and presents a very attractive and inviting appearance.

The playgrounds of Minneapolis

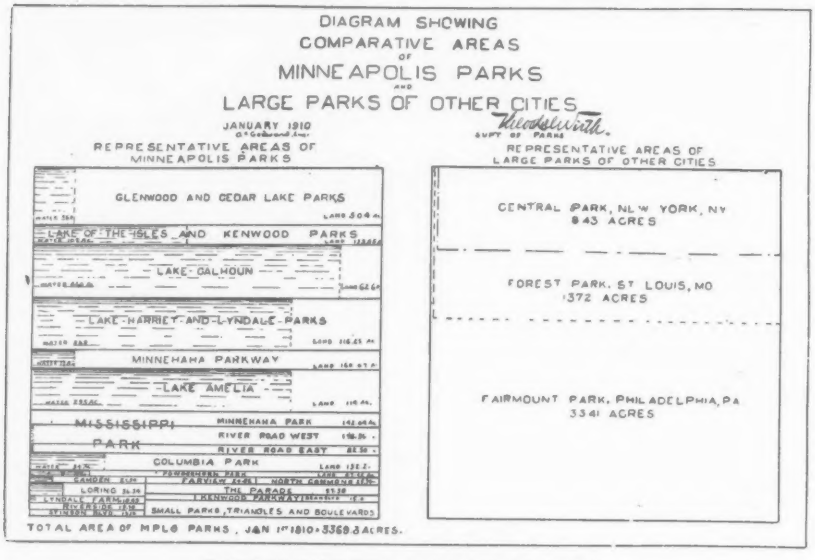
PARK SYSTEM OF MINNEAPOLIS, MINN.

III. Mississippi River Park Along West River Bank.

come indirectly under the supervision of the park commission, and seventeen playgrounds, having a total of twenty-five acres, have been established and equipped. This acreage includes tennis courts, base ball fields, etc. The total attendance at the playgrounds in 1909, something over 496,000, indicates their popularity.

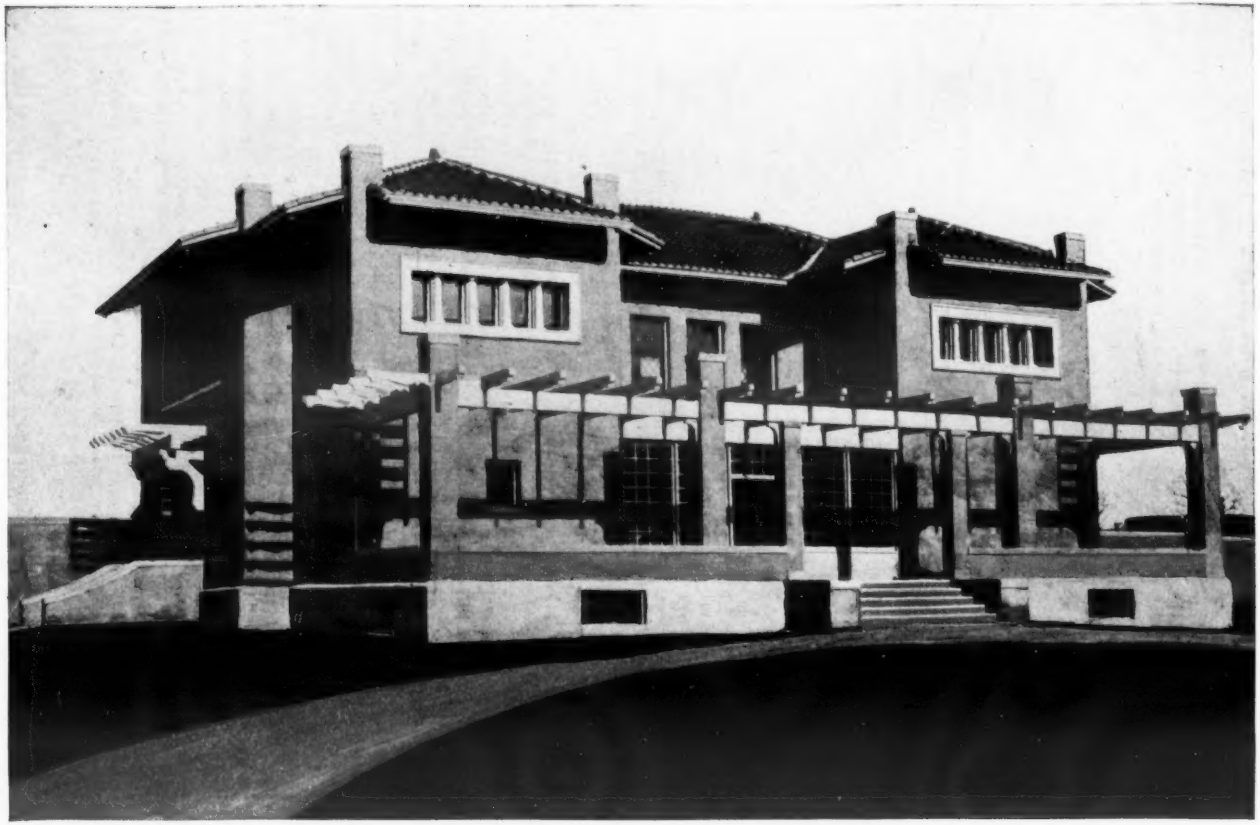
The engineering work of the park department is carried on distinct from the regular city engineering force. Two parties are kept in the field during the entire year, making topographic surveys, soundings, laying out roadways, sewers, and walks, and making up plans and estimates on bridges, dams, etc. One of the most notable undertakings of this department has been the connection of the chain of lakes by means of channels, so as to make a continuous waterway from Lake Harriet to Brownies' Lake. This undertaking will involve the building of channels and locks, so as to maintain the water levels of the different lakes, and the construction of numerous bridges at points where the park drives cross the proposed waterway. In connection with this project it has been necessary to dredge out the Lake of the Isles, converting it from a shallow marsh into a lake with elevated banks forming a raised boulevard around its entire circumference. This work has but lately been completed.

To the efficiency of all departments, and to the thoroughly business administration of all park affairs may be ascribed the credit for the present excellent system. All accounts are kept accurately to the smallest detail, and full publicity is given to every act of the commission. The commission's actions have not always been without criticism from the public and the press, but at present public opinion is heartily in accord with all that has been done. A far sighted policy, which labored to procure all necessary park territory before proceeding to the refinement of any particular area, has been strictly observed; and with a future advancement as marked as has been the past, Minneapolis should have a park system unexcelled by any.



PARK SYSTEM OF MINNEAPOLIS, MINN.

IV. Diagram Comparing Park Areas in Minneapolis and Other Cities.



PARK SYSTEM OF MINNEAPOLIS, MINN.

V. John D. Webber Field House, Camden Park.

Specifications for Asphalt Pavements

By E. M. Perdue, Chemical and Consulting Engineer, Kansas City, Mo.

FOR a number of years I have made the study of asphalt pavement a specialty. In every way I have advocated a closer specification, strict municipal supervision, and the abolition of the five or ten-year maintenance. It is obvious that for these reasons I could have no part in standardizing specifications.

A technical chemical and constructing engineer would gather from the "Standard Specification," adopted by the Organization for Standardizing Paving Specifications, that the asphalt paving industry was in its infancy, that it had no standards, that it was still a matter of experiment and was largely guess work. The facts are that the physical constituents of asphalt pavement are as actually determined as the chemical composition of Portland cement; they can vary within as narrow limits, and can be as satisfactorily and accurately filled by the contractor.

Asphalt pavement is one of the best of pavements. It can be laid on streets of the heaviest traffic so as to need no repair for a period of ten years and at the same time be smooth, clean and sanitary. Yet municipal engineers have permitted paving contractors to influence them to write a wide-open specification and so cloud the real points of value with chemical analyses until the so-called asphalt pavement disintegrates in two years and has become unpopular.

Three pages of your edition of the Standard Specification (5, 6 and 7) are devoted o a confusing, illogical and wholly unprofitable mixture of requirements of derivation, physical and chemical properties, specific gravity, natural asphalts and the products of distiilation. What difference does it make whether an asphalt comes from Trinidad Lake or the Island of Trinidad, the Province of Bermudez, Cuba, Utah, Kentucky or Oklahoma, or is the product of the distillation of an asphaltic, semi-asphaltic or paraffin petroleum; has or has not a particular ductility, viscosity, penetration and flash point; is soluble to a particular percentage in carbon disulfid and carbon tetrachlorid and petroleum naphtha; has a fixed residue of a given percentage on ignition? These requirements only serve to make the specification abstruse, difficult, beyond the comprehension of the average engineer and impossible to the public.

The only considerations of value to the municipality and to the abutting property owner are that the combinations of asphalt and flux, commonly called asphaltic cement or A. C., have the proper ductility, viscosity and penetration to insure a good pavement. These are all physical and not chemical properties. Given proper ductility, viscosity and penetration, and the solubilities, residues, origin and derivation will take care of themselves. Their requirement cumbers the specification, their determination is a useless expense and labor.

A large part of pages 9 and 10 is devoted to the "binder course." Now, there are three good reasons for laying binder.

1. It increases the cost of the pavement to the property owner.

2. It requires more work.

3. It promotes the rapid disintegration of the surface. As a matter of scientific engineering, especially as applied to the principles of viscous pavements, the binder course is obsolete. It is a relic of the early days of the industry. It should never be laid.

The "mixes" of concrete aggregates and the aggregates of macadam, bitulithic, Hassam and asphalt pavements depend upon the theory of bonding density. This rule applies with greater strictness where the bonding material is bituminous. The set of the limes is the chemical process of hydration. It is rigid and absolute. The set of the bitumens is physical and viscous and depends upon temperature. Therefore, to make a rigid pavement, the stability must be in the mineral aggregate and not in the cementing material. For this reason, the sand grading is the most important feature of the mix.

The sand and lime dust can be graded so that the voids will not exceed 25 per cent. This 25 per cent. must be filled by asphaltic cement. The average specific gravity of the sand will be 2.6. The average specific gravity of the asphaltic cement will be 1. The standard percentage of asphaltic cement is 10.0 for light traffic streets and 10.5 for heavy traffic streets. Nine per cent. is a low minimum and 11 per cent. a high maximum.

As asphalt pavement is not laid as a matter of municipal improvement but as a means of exploiting the abutting property owner and mulcting him in liability for special assessments, it is deemed necessary to require a "maintenance bond." This is a two-edged sword, cutting the property owner both ways. The surety is an approved bonding company. This company charges a premium. The contractor adds this premium to his bid. The surety company requires collateral security. The contractor adds this to his bid. The property owner complains of the high cost of the pavement. He is told of the high cost of the surety bond and maintenance. A poor pavement is laid under the common wide-open specification. The property owner complains of the quality of the pavement and the city engineer and board of public works tell him that it makes no difference as the paving company is under bond to maintain the pavement ten years. The pavement disintegrates in two years. The property owners complain. Then ensues an eight years' game of hide and seek between the paving company and four succeeding boards of public works. In the meantime the pavement is a series of bumps and holes and the city has paid several judgments for damages for personal injuries thereon.

The essentials of a good asphalt pavement are as follows:

1. A solid, well-drained sub-base.
2. A base of well-graded Portland cement concrete with a minimum thickness of six inches.
3. No binder course.
4. Asphaltic cement of the following properties: (1) Minimum ductility of 15 at 77 deg. F. (2) Penetration adapted to climatic conditions. A permissible variation of five points.
5. A surface coat two to two and one-half inches thick of the following grading:

	Light Traffic. Pct.	Heavy Traffic. Pct.
Asphaltic cement	10.0	10.5
Sand and filler passing .....200....	10.0	13.0
Sand passing ...100....	10.0	13.0
Sand passing ... 80....	10.0	13.0
Sand passing ... 50....	24.0	23.5
Sand passing ... 40....	12.0	11.0
Sand passing ... 30....	10.0	8.0
Sand passing ... 20....	8.0	5.0
Sand passing ... 10....	6.0	3.0

The asphaltic cement will bear a variation of one-half per cent., but should average as above. The sand grading should conform to the above standard in average. It will permit a variation of 2 per cent. on the sieves passing the larger amounts and of 1 per cent. on sieves passing the smaller amounts. When such a pavement is laid a maintenance bond is superfluous.

[EDITORIAL NOTE. This objection to the specifications for asphalt pavements adopted by the Organization for Standardizing Specifications, printed in MUNICIPAL ENGINEERING, vol. xxxviii, p. 234, and reprinted in a little volume of "Standard Paving Specifications," should be read in connection with those specifications and the modifications proposed by a sub-committee of the Committee on Standard Specifications of the American Society of Municipal Improvement, which will be found below. Reference may also be made to the accompanying editorial on this subject.]

Proposed Specifications for Sheet Asphalt Pavements

Report to the American Society of Municipal Improvement by F. P. Smith, Asphalt Chemist, New York City

GENERAL DESCRIPTION.

Upon the foundation prepared and laid as elsewhere herein specified shall be laid the pavement proper. This shall consist of:

1. A binder course..... inches in thickness when compressed.
2. An asphalt wearing surface ..... inches in thickness when compressed.

MATERIALS.

The materials used must comply with the requirements of these specifications and be suitable for use upon the street or streets to be paved. They shall be mixed in definite proportions by weight, depending upon their character and the traffic upon the street and upon the character of the asphalt used, and such materials and propor-

tions must be satisfactory to the engineer.

Crude natural asphalt shall be construed to mean natural mineral bitumen, either pure or mixed with foreign matter, from which, through natural causes in the process of time, the light oils have been driven off until it has a consistency harder than 100 penetration at 77 deg. F.

Asphaltic petroleum shall be construed to mean those petroleums which when treated in the manner specified below will give a residue having a ductility of 77 deg. F. of 25 cms. or over.

Semi-asphaltic petroleums shall be considered to mean those petroleums which, when treated in the manner specified below, will give a residue having a ductility at 77 deg. F. of between 5 cms. and 25 cms. and this residue, after being maintained at a temperature of not over 77 deg. F. for forty-eight hours, must have a bright and glossy surface which shows no signs of crystallization.

Method for examination of petroleums—Two hundred grams of the petroleum is to be placed in an open dish and subjected to a temperature in an air bath of not to exceed 500 deg. F. until the residue so obtained shall have a penetration at 77 deg. F. of 50. This residue is then to be tested for ductility at 77 deg. F.

Asphalts whose value for making pavements have not been established in the judgment of the engineer, by sufficient practical experience, will only be accepted under such special bond and guarantee provisions as the engineer may prescribe.

The preparation and refining of all asphalts admitted under these specifications shall be subject to such inspection at the paving plants and refineries as the engineer may direct.

Subject to the proceeding conditions and definitions, the following types of refined asphalt will be admitted under these specifications, provided that when made into asphalt cements by the use of such materials and methods as are described in these specifications they will produce an asphalt cement complying with the specification requirements elsewhere set forth herein for asphalt cements.

All tests herein specified must be conducted according to official methods on file in the office of the engineer.

1. Refined asphalts prepared by heating crude natural solid asphalts without the addition of any other material to a temperature not exceeding 400 deg. F. until all water has been driven off. Such asphalt must melt readily upon the application of heat.

2. Refined asphalt procured by the careful distillation of asphaltic petroleum until the resulting asphalt has a consistency not harder than 20 penetration at 77 deg. F. Such asphalts must comply with the following requirements:

(a) They shall contain not less than 98.5 per cent. of bitumen soluble in cold carbon disulphide.

(b) When 20 grams of the asphalt are heated for five hours at a temperature of 325 deg. F. in a tin box 2 1-2 inches in diameter after the manner officially prescribed, it shall not lose over 5 per cent. by weight nor shall the penetration at 77 deg. F. of the residue left after such heating be less than one-half the penetration at 77 deg. F. of the original sample before heating.

(c) When the asphalt is brought to a penetration at 77 deg. F. of 50 by the use of the flux with which it is to be used and made into a briquette having a cross section of one square centimeter, it shall have a ductility of not less than 25 cms. at 77 deg. F.

Note.—Combinations of asphaltic and semi-asphaltic residues having the ductility and other characteristics noted above are admitted under this section.

3. Refined asphalt produced by combining crude natural asphalt with either or both of the following:

(a) Residuums obtained by the distillation of petroleum oils as specified under fluxes.

(b) Asphalts obtained from the distillation of asphaltic petroleums as specified under paragraph 2 of this section.

Note.—Where more than 5 per cent. of flux is used in the preparation of refined asphalts of this class, only asphaltic or semi-asphaltic fluxes shall be used, except in those cases where the solid natural asphalt is of such character that when mixed with paraffine fluxes without the further addition of any other materials it will produce an asphaltic cement complying with the requirements herein set forth under that head. In such cases, any of the fluxes herein specified may be used.

Fluxes shall be the residues obtained by the distillation of paraffine, asphaltic or semi-asphaltic petroleum and shall be of such a character that they will combine with the asphalt to be used to form a suitable asphalt ce-

ment complying with the requirements of these specifications.

The residuums must have a penetration greater than 3 1-2 cm. with a No. 2 needle at 77 deg. F. under 50 grams weight for one second.

A natural Maltha may be used if it passes the heat and flash tests specified under "a" and all fluxes must remain soft after heating for five hours at 400 deg. F.

(a) Paraffine residuums shall have a specific gravity of 0.92 to 0.94 at 60 deg. F. They shall not flash below 350 deg. F. when tested in the New York State closed oil tester and shall not volatilize more than 5 per cent. of material when heated five hours at 325 deg. F. in a tin box 2 1-2 inches in diameter as officially prescribed.

The residue after heating shall flow at 77 deg. F.

(b) Asphaltic residuums shall have the same general characteristics as paraffine residuums except that they shall have a specific gravity between 0.98 and 1.04 at 80 deg. F. When tested according to the method elsewhere herein described for the examination of petroleums, the residue so obtained shall have a ductility at 77 deg. F. of 25 cms. or over.

(c) Semi-asphaltic residuums shall have the same general characteristics as paraffine residuums except that they shall have a specific gravity between 0.94 and 0.98 at 60 deg. F. When tested according to the method elsewhere herein described for the examination of petroleums, the residue so obtained shall have a ductility at 77 deg. F. of between 5 and 25 cms. and must have a bright and glossy surface which shows no signs of crystallization.

Binder stone shall be clean, hard stone, free from any particles that have been weathered, or otherwise soft material. It shall all pass a 1 1-4-inch screen. Not less than 85 per cent. of the stone shall pass this screen in its largest dimensions, and of the remaining 15 per cent. no piece shall have a larger dimension than two inches. The stone shall be so graded from coarse to fine as to have the following mesh composition (sieves to be used in the order named):

Passing

16 mesh	16 to 35 per cent.
2 mesh	10 to 35 per cent.
Total	25 to 50 per cent.
1 mesh	20 to 60 per cent.
1 1-4 mesh	15 to 55 per cent.
Total	50 to 75 per cent.
Total passing 1 mesh.	45 to 85 per cent.

The above limits as to mesh composition are intended to provide for such permissible variations as may be rendered necessary by the available sources of supply and the character of the work to be done. The mesh composition and character of the stone may be varied, within the limits above specified, at the discretion of the engineer, depending upon the kind of asphalt used and the traffic conditions upon the streets or streets to be paved.

The sand shall be hard, clean grained and moderately sharp. On sifting it shall have the following mesh composition (sieves to be used in the order named):

Passing

200 mesh	0 to 5 per cent.
100 mesh	10 to 25 per cent.
80 mesh	6 to 20 per cent.
Total passing 80 mesh and retained on	
200 mesh	20 to 35 per cent.
60 mesh	6 to 20 per cent.
50 mesh	15 to 40 per cent.
40 mesh	10 to 30 per cent.
30 mesh	8 to 25 per cent.
20 mesh	5 to 15 per cent.
10 mesh	2 to 10 per cent.
8 mesh	0 to 5 per cent.

On very light traffic streets, a coarser sand may be used with the approval of the engineer, but in no case shall a sand be employed that contains less than a total of 15 per cent. passing an 80-mesh sieve, such total to contain not more than 5 per cent. (calculated on the original sand) passing a 200-mesh sieve.

The above limits as to mesh composition are intended to provide for such permissible variations as may be rendered necessary by the available sources of supply and the character of the work to be done. The mesh composition and character of the sand may be varied, within the limits above specified, at the discretion of the engineer, depending upon the kind of asphalt used and the traffic conditions upon the street or streets to be paved.

Filler shall be thoroughly dry limestone dust or Portland cement, the whole of which shall pass a 30-mesh per linear inch screen and at least 66 per cent. of which shall pass a 200-mesh per linear inch screen. The surface mixture shall contain from 6 to 20 per cent. of this filler, depending upon the kind of sand and asphalt used and the traffic conditions upon the street or streets to be paved.

Samples of the refined asphalt, petroleum flux and asphalt cement that the contractor proposes to use in his work must be handed in with the bid

and no contract shall be awarded to any bidder whose samples do not comply in every respect with these specifications.

In addition to the samples submitted with the bids, other samples taken from and actually representative of the refined asphalt, petroleum flux, sand and filler to be used upon the street shall be submitted to the engineer before the use of such materials in the work is permitted. Except at his option, no work on binder or surface shall be commenced within three weeks from the date when such samples were submitted and in no case shall they be used until they have been examined and approved by him. Whenever, during the course of the work, new deliveries of paving materials are received by the contractor, samples of these shall at once be submitted to the engineer and their use in the work will not be permitted until they have been examined and approved by him.

ASPHALT CEMENT.

The asphalt cement prepared from the materials above designated shall be made up from the refined asphalt or asphalts, and the flux, where flux must be used, in such proportions as to produce an asphalt cement of a suitable degree of penetration. The proportion of the refined asphalts comprising the cement shall in no case be less than 40 per cent. by weight. When the weight of the flux in the asphalt cement prepared from solid natural asphalts exceeds 25 per cent. thereof, asphaltic or semi-asphaltic flux shall be used.

The refined asphalts and flux comprising the asphalt cement shall, when required, be weighed separately in the presence of the authorized inspectors or agents of the engineer.

The proper proportions of the refined asphalt or asphalts and the flux shall be melted together and thoroughly agitated by suitable appliances until they are completely blended into a homogeneous asphalt cement. The asphalt cement must never be heated to a temperature exceeding 350 deg. F. If the asphalt cement contains material that will separate by subsidence while it is in a molten condition, it must be thoroughly agitated before drawing from storage and while in use in the supply kettles. Approved methods of agitation, which will not injure the cement, must be used.

The asphalt cement shall comply with the following requirements:

(a) When tested with a No. 2 needle in a Dow penetration machine, or its equivalent, it shall have a penetration, expressed in hundredths of a centimeter, within the following limits: It shall be between 35 and 75 penetration at 77 deg. F. under a weight of 100 grams for five seconds, depending upon the asphalt used and the traffic upon the street on which the pavement is to be laid.

(b) It shall not flash below 350 deg. F. when tested in a New York State closed oil tester.

(c) When heated in an open tin at a temperature of 325 deg. F. for five hours in a hot air oven, it must not show a loss by volatilization of over 5 per cent. and the penetration at 77 deg. F. of the residue left after such heating must not be less than one-half the penetration at 77 deg. F. of the original sample before heating.

(d) When the pure bitumen of the asphalt cement is brought to a penetration at 77 deg. F. of 50 and made into a briquette tapering in the middle to a minimum cross section 1 cm. square, it must stretch to a distance of 15 cms. or over without breaking when tested for ductility at 77 deg. F.

BINDER.

The binder shall be composed of stone and asphalt cement of the character elsewhere herein specified and mixed in proper proportions. If the stone does not contain the proper amount of material passing the 1-2-inch screen, the deficiency may be made up by the addition of gravel or sand. The stone and the asphalt cement shall be heated separately to such a temperature as will give, after mixing, a binder mixture of the proper temperature for the materials employed. The stone when used must be at a temperature between 200 and 325 deg. F. The asphalt cement and stone shall be thoroughly mixed by machinery in such proportions that the resulting binder shall have life and gloss without an excess of asphalt cement and the mixing shall be continued until a homogeneous mixture is produced in which all the particles are thoroughly coated with asphalt cement. The finished binder must contain from 5 to 8 per cent. of bitumen and from 10 to 30 per cent. of material passing a 10-mesh screen, the percentage of bitumen to be regulated in accordance with the mesh composition and character of the mineral aggregate of the binder.

The binder mixture prepared in the manner above described shall be brought to the streets in wagons at a

temperature between 200 deg. F. and 325 deg. F. and shall be covered with canvas covers while in transit. The temperature of the binder mixture within these limits shall be regulated according to the temperature of the atmosphere and the working of the binder. On reaching the street it shall at once be dumped on the concrete and then be deposited roughly in place by means of hot shovels, after which it shall be uniformly spread by means of hot iron rakes and then at once be thoroughly compacted by tamping or rolling. The depth of the finished binder shall at no place be less than one or more than three inches and its upper surface shall be parallel to the surface of the pavement to be laid. All binder that shows lack of bond or an excess of asphalt cement, or that is in any way defective or which may become broken up before it is covered with wearing surface must be taken up and removed from the street and replaced by good material at the expense of the contractor. No more binder shall be laid at any one time than can be covered by two days' run of the paving plant on surface mixture. Binder when laid shall be followed and covered with wearing surface as soon as is practicable, in order to effect the most thorough bond between the binder and the wearing course. The binder course shall be kept as clean and as free from traffic as is possible under working conditions. If necessary it must be swept off immediately before laying the wearing surface upon it.

No binder shall be laid when, in the opinion of the engineer, the weather conditions are unsuitable or unless the concrete on which it is to be laid is dry and has set a sufficient length of time.

WEARING SURFACE.

The wearing surface shall be composed of sand, filler and asphalt cement of the character elsewhere herein specified and mixed in proper proportions. The sand and the asphalt cement shall be heated separately to such a temperature as will give, after mixing, a surface mixture of the proper temperature for the materials employed. The sand when used must be at a temperature between 250 deg. F. and 375 deg. F. The filler shall be added to the hot sand in the required proportions, and the two thoroughly mixed. The asphalt cement at the required temperature and in the proper proportions shall then be added and the mixing continued for at least one minute in a suitable apparatus until a homogeneous mixture is produced in which all the particles are thoroughly coated with asphalt cement. The weights of all materials entering into the composition of the wearing surface shall be verified in the presence of inspectors as often as may be required and the engineer or his representative shall have access to all parts of the plant at any time.

The surface mixture prepared in the manner above described shall be brought to the street in wagons at a temperature between 230 deg. F. and 350 deg. F. and shall be covered with canvas while in transit. The temperature of the surface mixture within these limits shall be regulated according to the temperature of the atmosphere and the working of the mixture. On reaching the street, it shall at once be dumped on a spot outside of the space on which it is to be spread. It shall then be deposited roughly in place by means of hot shovels, after which it shall be uniformly spread by means of hot iron rakes in such a manner that, after having received its final compression by rolling, the finished pavement shall conform to the established grade and have a thickness of not less than ..... inches. Before the surface mixture is placed all contact surfaces of curbs, manholes, etc., must be well painted with hot asphalt cement. The surface shall then be compressed by rolling or tamping, after which a small amount of cement shall be swept over it and it shall then be thoroughly compressed by a steam roller weighing not less than 200 pounds to the inch width of tread, the rolling being continued until a compression is obtained which is satisfactory to the engineer. Such portions of the completed pavement as are defective in finish, compression or composition or that do not comply in all respects with the requirements of these specifications, shall be taken up, removed and replaced with suitable material, properly laid, in accordance with these specifications, at the expense of the contractor. Whenever so ordered by the engineer, a space of twelve inches next the curb shall be coated with hot asphalt cement, which shall be ironed into the pavement with hot smoothing irons.

The finished pavement shall contain between 9 1-2 per cent. and 12 1-2 per cent. bitumen soluble in cold carbon disulphide, depending upon its mesh composition and the character of the sand used and the traffic to which it is to be subjected, but in all cases

sufficient asphalt cement must be used to properly coat all the particles of the mineral aggregate. It must also contain not less than 10 per cent. of mineral matter passing a 200-mesh sieve and not less than a combined total of 25 per cent. passing the 200, 100 and 80-mesh sieves. On streets of light traffic, when the engineer has approved the use of a coarser sand than that specified for general use, the surface mixture must contain not less than 6 per cent. of mineral matter passing a 200-mesh sieve and not less than a combined total of 18 per cent. passing the 200, 100 and 80-mesh sieves. The maximum amounts of 200, 100 and 80-mesh material in the pavement will be regulated according to the kind of sand and asphalt used and the traffic upon the street upon which the pavement is to be laid, subject to the maximum requirements elsewhere herein specified under Sand and Filler.

The above limits as to mesh composition and per cent. of bitumen are intended to provide for such permissible variations as may be rendered necessary by the raw materials used and the character of the work to be done. The composition of the wearing surface may be varied within the limits above specified at the discretion of the engineer, depending upon the kind of sand, filler and asphalt used and the traffic conditions upon the street or streets to be paved.

No wearing surface shall be laid when, in the opinion of the engineer, the weather conditions are unsuitable or unless the binder on which it is to be placed is dry. The finished pavement must be well protected from all traffic by suitable barricades until it is in proper condition for use.

CONDITION AT EXPIRATION OF GUARANTEE.

In addition to the proper maintenance of the pavement as provided for elsewhere herein, the contractor shall, at his own expense, just before the expiration of the guarantee period, make such repairs as may be ordered by the engineer and as may be necessary to produce a pavement which shall:

(a) Conform substantially in grade to the pavement as first laid.

(b) Be free from cracks more than three feet in length.

(c) Contain no disintegrated surface mixture.

(d) Not have been reduced in thickness more than 1-4 inch in any part.

(e) Have a foundation free from cracks or defects.

(f) Be in substantial accord with the specifications under which the pavement was laid, except as otherwise provided for in this section.

REPAIRING.

Whenever the repairs made at any one time shall amount to more than 50 per cent. of the surface of any one block the entire pavement of that block shall be taken up and relaid. These repairs, except as provided for below, shall in all cases be made by cutting out the defective binder and wearing surface down to the concrete and replacing them by new and freshly prepared binder and wearing surface made and laid in strict accordance with these specifications.

Whenever any defects are caused by the failure of the foundation, the pavement, including such foundation, shall be taken up and relaid with freshly prepared material, made and laid in strict accordance with these specifications.

The surface heater method of repairing may be used only in those cases where the repairs are not rendered necessary by:

(a) Failure of the concrete.

(b) Failure of the binder.

(c) Failure caused by the disintegration of the lower portion of the wearing surface.

Whenever the surface heater method is employed, all defective surface shall be removed before replacing it with new material. In all cases the old surface shall be removed to a depth of not less than 1-4 inch and the new surface mixture must, when compressed, be not less than 1-2 inch in thickness. The heat shall be applied in such a manner as not to injure the remaining pavement. All burnt and loose material shall at once be completely removed and while the remaining portion of the old pavement is still warm, shall be replaced by new and freshly prepared wearing surface made and laid in strict accordance with these specifications.

The Argument for State Highway Commissions*

By Logan Waller Page, Director of U. S. Office of Public Roads, Washington, D. C.

THERE are no better examples of high grade road construction than can be found today in the United States. It is equally true that the world possesses no better examples of poor maintenance. While construction is the first essential to road improvement, maintenance is of equal importance for the attainment of a perfect system, and, as a prerequisite to good maintenance, a thorough administrative system must be provided. While it is necessary that we devote immediate attention to the study of methods of construction to meet modern traffic conditions, and while the deliberations of great conventions will undoubtedly prove of real value, we should carefully guard against becoming too much absorbed in problems of construction to the neglect of the equally important problems of maintenance. The one point of clearly demonstrated superiority which the European road systems possess over our own is in their exceptionally effective administration and maintenance.

The whole subject of road improvement in the United States is today in a transition stage. We are not only endeavoring to meet the new conditions of traffic with new forms of construction, but our various state legislatures are actively engaged in an endeavor to meet the demand for road improvement by the enactment of suitable legislation and the appropriation of necessary funds. The fact that we are in this transition stage makes it not only opportune, but imperative, that our legislation be concise, practical and effective to the end that we may obtain and continuously maintain perfect systems of roads at the lowest possible cost. Although many of our states are appropriating large sums of money for the construction of new highways, yet few of them are making adequate provision and appropriation for the maintenance of these highways, the result being that roads are being constructed in short sections each year, to be worn out before continuous lines of road are completed. We now have a real and lasting opportunity to render a great public service by urging the adoption of those principles which have proven by long experience in other countries to be sound and effective.

The first and basic principle which underlies the most successful of European systems of road administration, and which is the basis of the most successful of our state systems in America, is centralization.

We have tried many expedients in America in the management of public roads, among them the toll road system which involves private control of a public utility. This is manifestly unsound in public enterprises, and it is a source of gratification that the toll road system has been largely abandoned throughout the country by the more progressive states, in favor of some system of public control and public expenditure. We have tried a system of public control through local units, involving the principle of extreme localization, in which the counties or their sub-divisions were made the unit of control, and this system unfortunately prevails today in approximately half of the states. Even in the states which have followed a progressive policy during the last few years, by far the larger portion of the roads is still under local control. This system is manifestly a failure, and we have found by careful investigation that the annual expenditure for road improvement in the United States is about $1.05 per capita, which on the present basis of population would be upwards of $95,000,000 a year. Our roads are admittedly the poorest to be found among any of the foremost nations, and the examples of roads commensurate with their expenditures are exceedingly rare. Besides, it is not merely a single county here and there throughout the state that should have improved roads, but continuous lines of improved roads should traverse the entire state.

The superiority of the centralized system over the system of local control is made more manifest when we compare the experience of England and France. The roads throughout England are almost uniformly excellent, but by reason of their lax system of local control, the cost of maintenance is very great. The annual expenditure for 1905 and 1906 was a lit-

* A paper before the National Good Roads Convention.

tle over $78,000,000, and, as the total mileage is slightly less than 150,000, it follows that the annual expenditure per mile was about $520. In comparison with this, the French roads, under a highly centralized system, are kept in a perfect state of repair at an average cost for the same period of about $244 per mile. A comparative analysis of the two systems reveals the cause of this marked difference in expenditure. The English system provides a large number of petty units, each under the control of an official independent of any central authority, in consequence of which uniformity of methods is impossible. While one official may conduct his work with skill and economy, it is scarcely reasonable to expect all of the officials to be equally efficient, consequently the saving in some of the units will be far more than offset by the waste in others. Furthermore, the incompetence of a large number of officials is more difficult to remedy than the incompetence of a single official. It is manifestly impossible for a small unit with limited revenues to secure the assistance, advice and supervision of a high-grade engineer, whereas in a centralized system the cost is so widely distributed as to constitute but a slight burden on each of the smaller units. In the purchase of supplies and equipment, a large saving can be effected by centralization, while in the reduction of personnel, and in standardization of methods and equipment still greater economy results.

In applying this principle to road administration in America, it must be apparent that the smallest unit for effective control is the state. Our own experience since the inauguration of the state-aid plan by New Jersey in 1891 has been uniformly in support of the wisdom of this contention. There has not been a single instance in which a state having once adopted in any measure the principle of state control and state aid has retrograded from its position. On the contrary, in almost every case increased power has continually been given to the highway departments of the states and larger appropriations granted. Not only has this been true, but it is a matter of common observation that the state roads throughout the country are far superior to the local roads, while in percentage of roads improved, the state-aid states are far in advance of those which are still adhering to the local system.

A particular phase of the centralization system which merits the fullest consideration is the tendency of the state aid system to build and maintain continuous trunk-line systems entirely at the expense of the state. State-aid legislation has followed in a large measure a process of evolution, the earlier laws being designed merely to give aid to the local sub-divisions. Later the principle of state control was emphasized in increasing measure, until today we have several examples of complete state supervision over definite lines of road. It is not only my hope, but belief, that every state will eventualiy adopt a system the most important essential of which will be the trunk line road supplemented by intercommunicating roads, in which a graduated system of state control will be exercised, and which will receive state-aid according to their importance.

I desire to call particular attention to the system prevailing in New York, which is the product of legislation extending over a period of 12 years, beginning in 1898. Until 1898, a system of extreme localization prevailed in New York. In that year, legislation was enacted providing that the small local units should receive a certain percentage of aid from the state, the amount depending upon the local expenditure. Thus the first step was far short of the highly centralized system now prevailing. In 1903 another step was taken when the legislature adopted a resolution proposing an amendment to the state constitution authorizing the issuance of $50,000,000 in state bonds for the building of state roads. This was ratified by the people in 1905, and the legislature of 1907 provided for a system of state aid which involved supervision by the state highway department, the state control, however, pertaining only to the roads built with the aid of state money. The tendency toward a more effective administration was apparent, however, in the appointment of a committee by the legislature in 1907 to undertake the revision of the state highway laws and propose a system. This report was adopted, and the new law became effective at the beginning of 1909. It provides for the construction of trunk lines to be built and maintained entirely at the cost of the state, and a tentative system was approved aggregating a length of about 2,800 miles. The county roads, comprising about 7,500 miles, are to be improved by the state, county and town jointly. The remainder of the roads, aggregating between 65,000 and

70,000 miles, are to be maintained and repaired by the towns with the aid of money appropriated by the state on condition that the local officials conform strictly to the methods specified by the state highway department.

This, in my opinion, constitutes an admirable arrangement, and the New York law, in my judgment, is today more nearly perfect than any of the state laws. Most important of all, New York has adopted a continuous system of repairs consisting of regular patrols, whose duty it is to maintain the roads at all times.

Summing up the advantage of state control of road improvements, we may confidently claim for the system that it makes practicable high grade, skilled supervision, as the funds will be adequate to employ the best men available. It should result in greater economy in both construction and maintenance, for the reason that a relatively smaller personnel will be required for administration and supervision, lower prices should be obtained in the purchase of equipment and materials; and a more accurate system of cost keeping and accounting is made possible. This system also should be productive of a far greater mileage of completed road, as it contemplates the construction of continuous lines of road rather than short, isolated stretches. To emphasize this point, we need only to recall an average instance of the distribution of county roads among various precincts. The distribution becomes so minute under the system of local control that the construction of any appreciable length of road is impossible. In consequence, even where short stretches of road are constructed, they may be said to begin nowhere and end nowhere, scarcely benefiting traffic, and, by reason of their location between stretches of unimproved roads, their proper maintenance is impracticable.

Aside from considerations of economy, we should not overlook the very important consideration that the expenditure of state funds tends to equalize the distribution of cost in a far more equitable manner than is possible under local control, for the reason that state revenues are derived from city and country as well as the large corporations, consequently, every interest in the state contributes to this important work of internal improvement.

Another point which I desire to emphasize as essential in any system adopted is, that skill and knowledge of road construction should be required of all officials having direct charge of road improvement. If we find it necessary to maintain technical schools for the training of military and naval officers, if in the states and counties we find it necessary to hold rigid examinations to test the fitness of teachers for our public schools, if the civil service system, which is generally approved in all units of government, is wise, why should we not require suitable qualifications on the part of the men who are to build and maintain our roads? If we turn to European precedents for light on the subject, we find that the two countries which are given credit for having the best road systems in the world, namely, France and Switzerland, require all of their highway engineers in public service to possess diplomas from the schools of roads and bridges maintained by the respective governments.

Several of the states have within the past few years enacted legislation providing for the appointment of a highway engineer in each county to have entire charge of road work. This is an excellent provision, and is exactly in line with the policy which I am advocating. The fact must not be overlooked, however, that there are some counties which can ill afford to pay a salary sufficient to secure a well qualified highway engineer. To meet this difficulty, the law should provide for the consolidation of several counties into a road improvement district, where it seems necessary, at the head of which should be placed a highway engineer whose salary and expenses would be borne proportionately by each county.

It is a matter of sound business to require that all our road taxes be paid in cash. The wisdom of this plan is so apparent as to need no vindication. The building and maintenance of roads is simply a great business enterprise conducted by the public. If a private enterprise could not succeed with its revenues partly paid in worthless labor and partly in cash, we have no right to assume that a public enterprise would succeed any better. Under normal conditions, I would most earnestly advocate the payment of all road taxes in cash, rather than in labor, but sometimes there are conditions which, in their relation to this subject, can scarcely be considered normal. I have in mind the problem throughout the South, where a large element of the population is capable of paying road taxes only in labor.

In those states, a change in the road laws relating to taxation for road purposes should only be made after a most careful consideration of these complex conditions.

In our eagerness to correct the evils in our existing systems of road administration we are apt to tear down faster than we can build up. I would, therefore, particularly urge that before we adopt sweeping legislative reform abolishing statute labor and toll roads, we make sure that we have a better substitute. I have in mind one or two instances where toll roads were abolished and no substitute provided, the result being that the road, which was poorly maintained before, received absolutely no maintenance after the law went in effect.

In dealing with the subject of actual maintenance aside from its administrative features, it must be evident that the only wise and safe plan is to provide, upon careful estimates, an actual cash appropriation sufficient to maintain every mile of new road that may be constructed, and at the same time provide a practical organization and a clear-cut, specific plan whereby this maintenance fund can be expended to the best advantage. It is necessary that the maintenance fund be kept absolutely separate and distinct from the construction fund, as otherwise the construction fund will be sure to borrow continuously from the maintenance fund and the intent of the law will be nullified. Continuous and systematic maintenance is the only solution of the maintenance problem. Damage to a road either from traffic or weather can be repaired at its inception with a slight expenditure of time and money, but if allowed to go without attention for a considerable length of time, will certainly involve great outlay for repair, and may even threaten the very existence of the road. The patrol system as practiced abroad and as established in the state of New York possesses many points of superiority over our usual practice of making repairs once or twice a year or when absolutely necessary. A distinction should be made between the continuous maintenance by the patrol system and extraordinary repair, such as failure of a bridge, culvert or a washout. An organization permitting of such repair should exist independently of the regular construction and maintenance forces.

The Office of Pubilc Roads has used its utmost endeavors to bring about the necessary reforms along these lines, as far as conditions have permitted. It is our endeavor to remedy the lack of knowledge of ordinary road construction in rural communities by sending out engineers to advise fully with the local officials and to give them the benefit of careful instruction in methods of construction and maintenance. These engineers are assigned upon the request of the local authorities, the entire expense of such assignments being defrayed from our appropriation. We are endeavoring to aid in some degree in providing skilled highway engineers to meet the demand by training every year in all branches of road work a small number of engineer graduates. The instruction given these young men is not gratuitous in the usual meaning of the word, as they render ample service in return for the instruction and the small compensation which they receive. We issue from time to time bulletins bearing upon various phases of road work, and when practicable, our engineers deliver lectures in local communities, in which they give information that will aid in solving the local road problems. Our investigative work is devoted to the various problems in connection with the construction and maintenance of roads, among the most important being the adaptation of methods of construction to meet modern traffic conditions. Another important project of an investigative character is comprised in our various experiments looking to the utilization of by-products in road building. Our laboratories also analyze and test road materials to determine their relative value and suitability for road constructions. This work is done free of charge for any citizen of the United States. A number of specialized projects arise from time to time through our study of road materials, which it is unnecessary to deal with in this paper.

In conclusion, I wish to state that if we are to accomplish these needed reforms, we can only do so through the medium of organized effort, and this organized effort should not be restricted to the holding of a few conventions here and there, but should include continuous and unremitting effort. I wish further to emphasize a point which I consider vital to the success of any great road organization, and that is that it should be built from the bottom up, or, in other words, that it should be composed of an aggregation of small local associations, which should be in intimate touch with local needs and problems, and which would give a national association a thoroughly representative personnel.

Top Soil Roads in Clarke County, Georgia

By Prof. C. M. Strahan, University of Georgia

THE methods followed in building the public roads of Clarke county, Georgia, which have spread to more than a score of other counties in the state, have given a new word to road literature, which, when rightly understood, will carry a new hope to many communities struggling with a meagre purse and impassable roads. Good roads have always been possible with limited mileage to be constructed and with pocketbook well filled. But a comprehensive system of good roads reaching the majority of the country landowners has seemed, and still seems, to many counties, a thing practically unattainable. The average Georgia county has four hundred miles of public highways and a taxable value of $4,000,000. An annual road expenditure of $20,000, calling for a tax levy of five mills, is a heavy tax, when added to the other demands upon the county treasury. Knowing that macadam and gravel roads cost from $3,000 to $9,000 per mile and require a maintenance cost of about $100 per mile, the rate of road building progress with this $20,000 (three to six miles per year) postpones for 25 years or more direct benefit to a large portion of the tax payers. Approached from the side of a bond issue, such a county, issuing $200,000 worth of road bonds, would virtually exhaust its constitutional borrowing power, would assume an annual debt for interest and sinking fund of nearly $20,000 and would build not more than 50 of its 400 miles of road in the macadam type. Weak counties are unwilling to assume such burdens. They do not feel safe in relying upon the increase of property values to reestablish the borrowing credit of the county. And, hence, road improvement lags.

If, however, a method of road construction can be found locally whose cost does not exceed $1,000 per mile, and whose results are reasonably efficient, as shown by the satisfaction of the public and a low maintenance after construction, the problem takes on a different aspect. Either by bonds or by yearly revenue it becomes possible to complete a large mileage in ten or fifteen years and the benefits are widely felt throughout the entire county.

The top-soil roads of Clarke county are of this class and are the outcome of a situation somewhat similar to that outlined above. They were begun in direct answer to popular discontent with the slow progress and very limited mileage of macadam roads which could be secured with $100,000 of bonds. When about half of the bond money had been spent on macadam construction and when only eight miles of road had been built, the change of program was inaugurated.

Mr. W. S. Holman, the superintendent, made this argument to himself. Many stretches of road, where the top layer of soil had not been disturbed, remained in good condition at all times. Frequently such stretches showed very little wear after a century of use and were still nearly flush with the adjoining fields. Why would not the top soil from the field near by, if spread upon the roadbed, pack down into a firm, smooth, water-resisting and durable surface coat? He had the courage to answer this question by ample experiment and to the full satisfaction of the public during four years past. The answer is now spread out over Clarke county in 60 miles of highway, broadened to 30 feet and surfaced 10 inches deep and 16 feet wide, with selected top soil as the wearing coat. The cost of placing, consolidating and shaping this wearing coat, using convict labor, has averaged $500 per mile. The entire cost of the roads, including much heavy grading and ample permanent drainage, has been $1,000 per mile. As engineer of the county, the writer has been in close touch with this type of construction and has aided in every way its development as experience has modified our practice. A laboratory for the examination of top soils has been equipped and a large number of samples examined, both before and after using the material in construction. With four years' experience, with much success and with no failures, with a surprisingly low maintenance cost, with complete freedom from mud after repeated rains and alternate thaws and freezes, the writer does not hesitate to endorse the methods now in use and to give them publicity for the benefit of other sections of the country where similar top soil may often be found if intelligently sought out.

Our procedure in building a top-soil road is briefly this:

1. The road-bed is staked out and graded thirty feet wide under the engineer's plan and culverts are put in place. A four per cent. maximum grade is adopted on the main roads. Rarely, short stretches of six per cent. have been left. The bed is made level transversely but not specially dressed to exact surface.

2. Suitable top-soil is selected near by from open fields and purchased from the landowner. This is loosened to a depth of eight or ten inches and is spread upon the road-bed in a single layer ten inches thick and preferably twenty feet wide. Earlier practice used only sixteen feet width and a final crown of one inch per foot. The present crowning is about five-eighths inch per foot.

3. With the road machine, flat side ditches are excavated six inches deep and the earth is thrown against the top-soil as a shoulder.

4. The consolidation is effected by the passage of the construction teams and by the traffic. The top-soiling follows behind the grading, and is kept within a convenient distance. It is not necessary to wait for embankments to settle before applying the top-soil. In fact, should rainy weather come, the top-soil packs promptly and prevents the traffic from miring in the freshly made fill. Any disturbance of grade alignment is corrected by hauling in additional top-soil. The consolidation by the traffic is, of course, gradual; and as the center packs down, the road machine is used to pull the sides inward and establish a smooth crown. In the course of six weeks or two months, a firm surface is perfected, which is so hard that the road machine will not cut it. Hence the importance of frequent dressing by the machine during the packing period and particularly after rains when the top-soil is moist.

5. Where the sub-soil material is weak and slippery and highly charged with mica, the top-soil layer is thickened to fourteen inches. No attempt is made to use rollers in consolidating the surface. The cost would be considerable and the amount of compression per inch width is not as great as from horses' hoofs and wagon tires.

The most vital point in the above process is to secure a suitable top-soil. What is a suitable top-soil?

1. It is the top-layer of soil on a cultivated field (or one formerly in cultivation) which has been intermixed and pulverized and exposed to the action of the weather and of plant life. Usually it shows the results of this action in being bleached out and is of a different consistency from the sub-soil below.

2. It must be a mixture of clay and sand or gravel. Rocks more than two inches in diameter should be shoveled aside in loading, or discarded when dressing the road. Very fine sand is objectionable. Samples separated in a nest of six sieves (graded from ten to one hundred mesh) which show much fine sand below the forty-mesh sieve should be rejected, as they will usually be deficient in clay. The coarse sand and gravel should be at least fifty per cent. of the mass, and of hard, tough consistency, not readily crushed by traffic. Mica in any considerable quantity seriously damages the soil for road purposes. Soft, black soils with large amounts of humus are entirely unsuitable. When separated by pulverizing and sifting, the contents of the finer sieves, when mixed with water, should give a sticky, smooth ball of nearly pure clay.

3. It must be found close to the new road—i. e., within a one mile haul of the place where it is to be used. Otherwise, the cost of hauling becomes very much increased, and the rate of progress is largely decreased, much to the public's discontent. A less valuable top-soil, with short haul, is preferable at the start to a better top-soil two miles or more away. However, when a reasonably good surface has been once formed with the near-by top soil, it will be feasible to haul large loads of the better top-soil over longer distances, with which to make a second more durable, wearing coat at small cost. This second coat can be, and is, put on in connection with the work of maintenance.

It will be noted at once that the top-soil road, as described, is a variation of what is widely known as the sand-clay road. It is virtually, as used in Clarke County, a semi-gravel road with clay binder. It differs from the artificial sand-clay road in this respect, viz., that in the top-soil the sand and clay are obtained in a state of intimate mixture and will consolidate at once when put in place. The artificial mixtures of sand and clay require either much time for the traffic to puddle them, or the expensive use of harrow, plows, and watering cart to bring them to suitable condition. Moreover, the pulverizing of the clay and its exposure to the weather and to vegetable action seem to influence strongly

PUBLIC COMFORT STATION, BROOKLINE, MASS.
I. Station is Underground in Front of the Fire Station in Center of the View.

its binding power. Once consolidated, the top-soil road no longer absorbs water, nor softens. Its surface is most perfect immediately after rain. Dry weather develops some dust but not in excess. The thick ten-inch bed is recommended in order that the traffic may not cut through into the softer foundation and allow ample material for wear.

While the name "top-soil roads" is not a scientific one, the writer justifies it as a term which really describes the surface material. He knows that top-soils of equal value are found with great differences in color and derived from quite different rock origins; that various semi-gravels of great road value abound in many counties throughout Georgia from the metamorphic areas down through Columbia Sands and Altamaha Grit; that similar soils with large content of coarse sand or gravel exist in the Carolinas, Tennessee, Kentucky and Virginia. He believes that the binding and waterproof quality of the clay is the result of pulverization and vegetable action. Hence no specific geologic name would so fitly embody the broad distribution and the special processes which the top-soil suitable for road building has undergone. As the result of investigations now in progress, it may be possible in the near future to systematize the clays and rock systems from which good road soil may be expected. Fortunately, the name top-soil road carries a valuable note of encouragement. Top-soils of some sort are found everywhere. It may be that many readers of this article will recall local soils of promising character and bring them to the attention of the road authorities in reach. Nothing wiser can be done by any community than to investigate the local possibilities for top-soil road construction. Even where the main roads are already built of a more expensive type, the secondary roads need betterment and can often find it by following up the top-soil idea.

This article would fall far short of its object unless it presented some concrete evidence of the acceptability and durability of the top-soil road. A recent Round-the-State-Tour of Georgia of more than a thousand miles was made in the interest of the road movement by seventy-five automobiles carrying three hundred people under the auspices of the Atlanta Constitution. That party found the best roads in Clarke County of North Georgia and in Sumter County of Middle Georgia. In both counties the roads are of top-soil construction. But the taxpayer's opinion is perhaps the best barometer. The last grand jury voices its belief that Clarke County has secured the best roads at least cost of any county in the state; and, now that the original bond money is exhausted, encourages the Road Commissioners to continue the top-soil program by increased direct taxation.

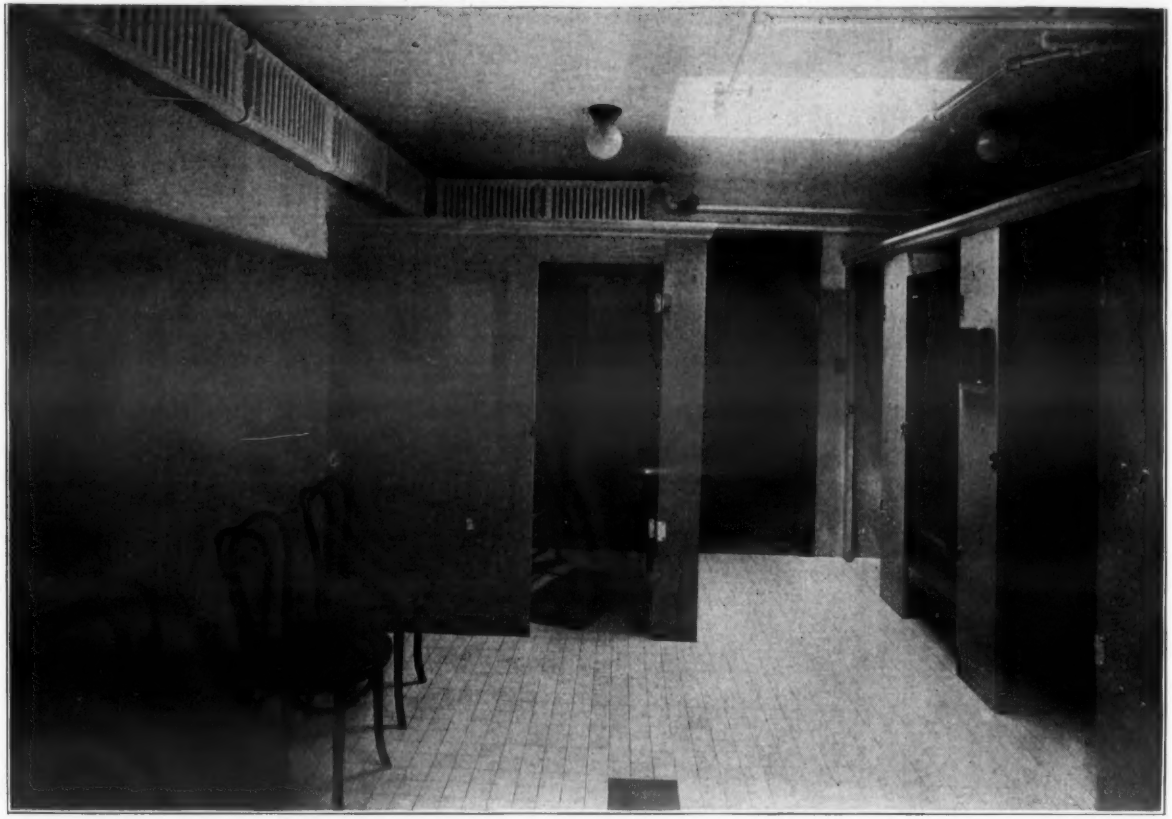
Four years ago, the writer, as an engineer, would have had serious doubt of road construction as herein presented. Today he has abundant confidence. He has seen important highways with relatively large rural traffic stand up for three years in all weathers with no mud and with a repair account less than $25 per mile. He has seen this top-soil surface maintain itself on grades as high as six per cent.; and he is familiar with long stretches of road where the motor cars are jocularly advised to slow down to ninety miles per hour. Where such roads can be surfaced for $500 per mile and maintained annually at less than $25 per mile, there is hope for good roads for every farmer and the poorest county or township can at least make a start.

Two Public Comfort Stations

SINCE the completion of the public comfort station in Indianapolis in July of this year a great deal of comment has been heard regarding the principles of its construction. The greater part of the criticism directed towards it dealt with the fact that it was neither of the above ground nor under ground type, but seemed to be a combination of the two. One individual was heard to remark that it was "all buried but the ventilating tower and it was left to stand out like a sore thumb.."

The public comfort station of Brookline, Massachusetts, was given as an example of the proper construction for an underground type of station.

As will be seen from the accompanying photograph, the Brookline station is entirely under the surface. The ground over it and adjoining has been



PUBLIC COMFORT STATION, BROOKLINE, MASS.
II. Retiring Room, Women's Section,

planted with shrubbery so as almost to conceal the station. The structure is built of reinforced concrete, the walls and roof being waterproofed by a heavy coat of roofers' pitch and with 5 layers of roofers' felt combined with hot pitch for a distance of 2 feet below the roof and by the use of 3 layers of felt to a level of 4 feet below the roof. The floor is placed 9 feet below the walk; the ceiling is 8.5 feet high and the roof is covered with 2 to 3 feet of loam.

On account of its non-absorbent characted and freedom from stain, gray Tennessee marble was used for the water closet partitions, urinal stalls and wainscoting, the height being 6½ ft. in the case of the water closets and 6 ft. elsewhere. White vitreous 3-in. x 3-in. x ½-in. tiles were used in the main rooms on account of their non-absorbent character and great durability.

A central compartment is provided in which all service pipes, flush boxes, soil pipes, etc., are located. This compartment is shown near the center of the floor plan given herewith. It allows access to make all plumbing repairs and provides ample protection against freezing of pipes.

The building is heated from the hot water system in the fire station plant, only 10 to 15 feet away, and is designed on the basis of 1 sq. ft. of radiation for each 40 cu. ft. of space to be warmed. In addition to this, a 9-ft. radiator is placed in each light shaft to aid in the warming and to keep the snow melted in winter.

A system of ventilation has been adopted, consisting of an electrically-operated fan placed in the pipe chamber near the ventilation shaft, with ducts leading to each closet and urinal, so that the air in the station can be exhausted through these fixtures at the rate of once in 15 minutes. It is believed that this will be ample to keep the air good under the worst weather conditions.

The station is well lighted during the day with six light shafts arranged as shown, in which are placed 2¾-in. luxfer prism sidewalk lights, spaced 4 in. on centers. During dull weather and at night it is lighted by electric lights controlled by suitably arranged switches.

The essential features of design of the Indianapolis station are very similar to those of the Brookline sanitary. The similarity of the floor plan arrangement may be noted from a comparison of the two drawings shown.

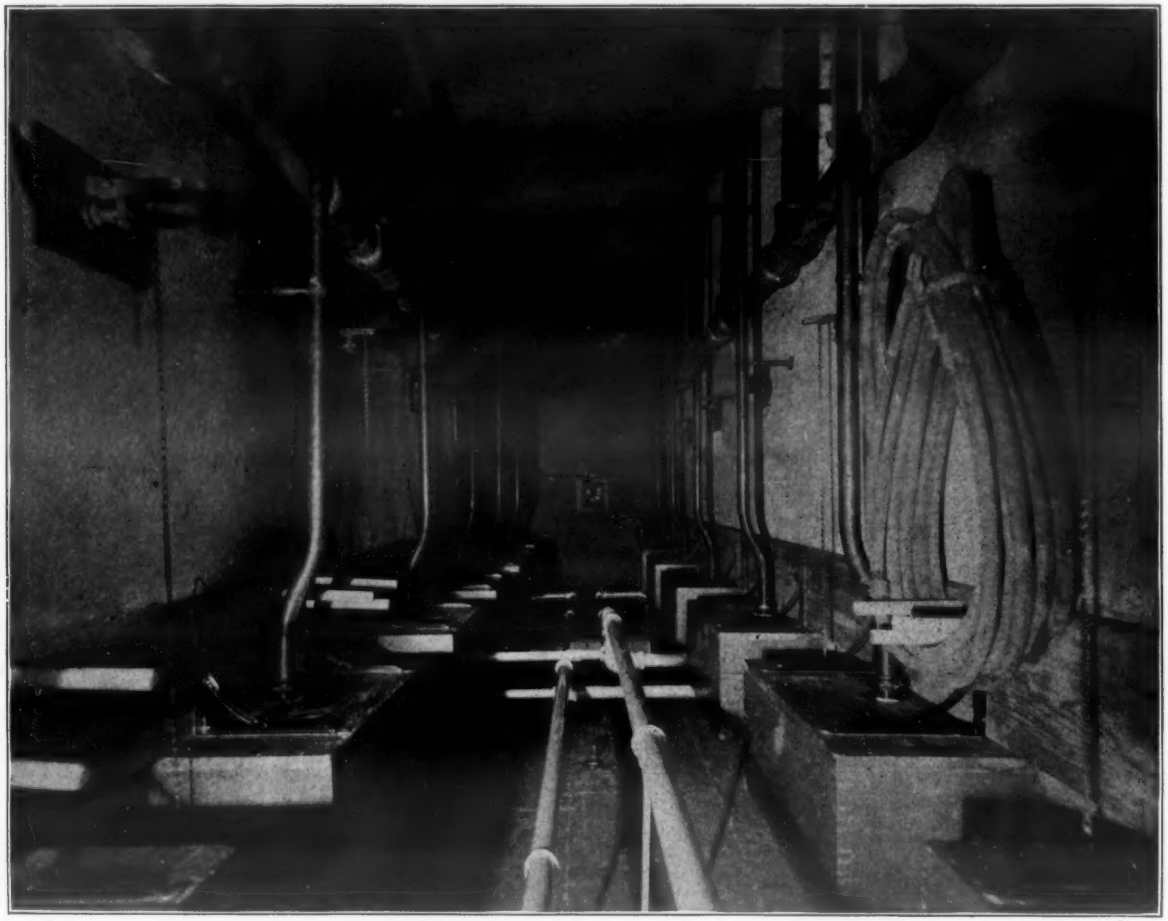
In the Indianapolis station double circular stairways at either end lead down to the floor level of the station. Between these stairways is an attendant's room, which on the women's side is furnished with a couch and benches. As in the Brookline station, a central compartment was provided for all flush tanks, pipes, the hot water heating tank and sewer pipes. With these features noted all similarity ceases, and the two differ in many details.

A number of questions other than those of architectural beauty, ease of of access and stable construction, influenced the planning of the Indianapolis public comfort station. An 8-ft. main trunk sewer down the center of Kentucky avenue follows the long axis of the station at a depth of only about nine feet. This necessitated the building of a portion of the station above the street line. The roof was placed at a height of about 3½ feet above the level of the street in order to discourage any inclination to sit upon it, and a narrow curbing nine inches in height was placed around the base so as to act as a buffer should vehicles come too close to the wall. Even with the raising of the structure it was necessary to remove about a foot from the top of the sewer and support the floor of the station on a grillage of I-beams placed transversely and supported on footings at the ends. On account of this location immediately over the top of the sewer, it was necessary to place all the toilets on a concrete platform nine inches above the floor level and to connect them to the soil pipe by means of a pipe from the back of the fixture instead of from the bottom.

A network of heat pipes, wire conduits, water lines, etc., made it necessary to construct the wing to one side of the center only. The roof over this wing and supporting the pavement on the west side of Kentucky avenue is formed of I-beams with arches of brick between. It was designed to support a 20-ton roller.

The walls throughout are of brick, varying in thickness from 18 inches to 2 feet and 6 inches. They were waterproofed with R. I. W. dampproof applied to the outer side. The inner side is lined with hollow brick and glazed white tile. The floors and roof are of concrete, the latter waterproofed with elastic paint.

The plumbing fixtures are of the latest approved type, white enamel, nickeled brass and marble being



PUBLIC COMFORT STATION, BROOKLINE, MASS.
III. Pipe-Chamber, Showing Piping for Water Supply.

used. All soil pipes have screw joints instead of being calked.

The pay closets, shown along the outer wall, are equipped with porcelain fixtures, including a wash basin, with hot and cold water, and a mirror, towels, liquid soap and a comb and brush are supplied in each of these compartments.

The ventilation is very good, particularly so in view of the location partially below ground level. A 20-in. tile pipe leads the air from the bottom of the stairs through to the side wall ventilators placed near the wall farthest from the source of outlet. A motor-driven disk fan, placed in the top of the ventilating tower shown in the photograph, draws the air through wall ventilators suitably placed. A separate hooded ventilator is placed back of each toilet fixture. Ventilators are also placed over each of the soiled linen closets. The building is heated by the Merchants Heat and Light Company, raditors being placed so as to occupy a minimum of available floor space.

The station complete cost slightly in excess of $17,000. It is under the care of one woman and one man attendant, and is open from 7:30 in the morning until 11:30 at night.

In comparing the two stations above noted it will be conceded from the success of the Brookline sanitary, now over a year old, that the underground type is more desirable. It may be adapted to use on downtown streets, space being required only for the entrances, and a treatment such as that of Brookline's station allows of greater privacy and less obstruction of traffic.

The central compartment for the plumbing fixtures is a point of value possessed by both the structures. Heating, ventilating and lighting facilities are excellent in both; as are the arrangements of the attendants' rooms, retiring rooms, etc. The one point of superiority which the Indianapolis station may claim is in the more recent type of fixtures adopted and the greater natural lighting facilities.

Since the Indianapolis station could not be placed entirely underground, the question arises as to why it should not have been put at or near the ground level, thus still further improving the lighting and ventilating facilities, reducing or eliminating entirely the steps to be climbed, and obviating the possible obstruction of flow of water in the sewer.

Indebtedness for pictures and plans is acknowledged to the *Journal of the Association of Engineering Societies* for the Boston Society of Engineers, to *Domestic Engineering*, and to Herbert W. Foltz and Wilson B. Parker, the architects of the Indianapolis station.

Some Provisions in Modern Franchises for Municipal Service Utilities*

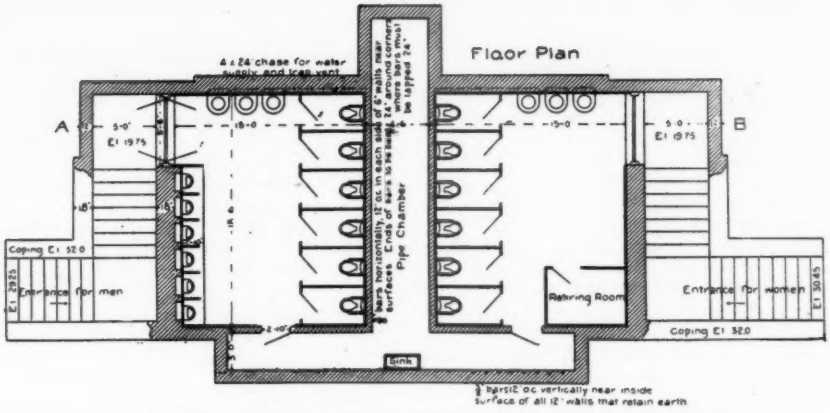
By Charles Carroll Brown, Consulting Engineer, Indianapolis, Ind.

THE states of the union are gradually adopting the principle of expert supervision of the formation and operation of public service corporations by state boards, for the almost uniformly satisfactory service rendered by those which have been established has demonstrated the practicability of the plan, and notable success in some states has shown that it is possible in practice to approach complete satisfaction to those satisfied with legitimately liberal returns.

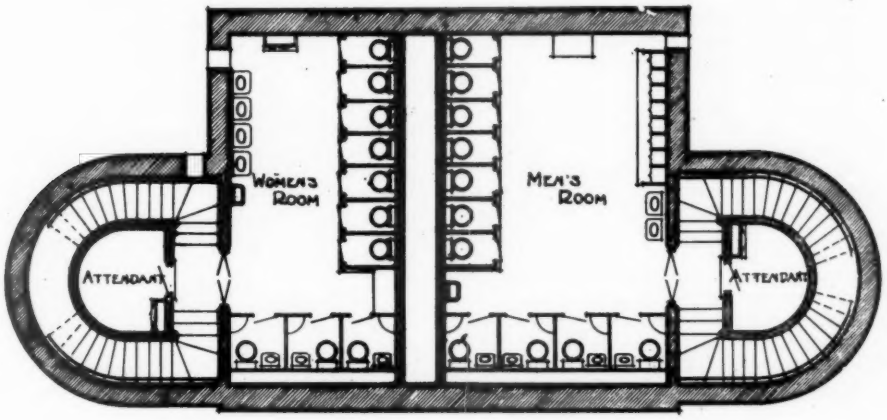
The influence of the work of the state public service commissions in the few states in which they have been established has been felt throughout the country, and in states not so favored this has been shown by the improved form of certain provisions in ordinances granting franchises to local service corporations.

The character of some of these provisions will be illustrated in this paper by quotations from two franchises recently granted, one of them after consultation with the writer and the other with the aid of William H. Bryan. While these provisions are not extensive they are advances and are signs of the course the advance is taking. The first is an ordinance which has been accepted by the Taylorville Railway, Light, Heat and Power Company and under which it is at present operating. A similar ordinance, varying

*A paper before the American Society of Municipal Improvement.



IV. PLAN FOR PUBLIC COMFORT STATION, BROOKLINE, MASS.



V. PLAN FOR PUBLIC COMFORT STATION, INDIANAPOLIS, IND.

VI. END VIEW OF PUBLIC COMFORT STATION, INDIANAPOLIS, IND.

only in details to conform with differences in condition is now under discussion between the city of Taylorville, Ill., and the Taylorville Gas and Electric Company, the principal point of difference being the rate proposed for the supply of gas.

The ordinance now in force grants the Taylorville Light, Heat and Power Company the right to construct overhead and conduit lines for the distribution of electricity in certain streets for which petitions of the residents have been received, and also the right to lay pipes in all streets for the distribution of steam for heating purposes.

The character and mode of maintenance of poles, wires, pipes, conduits, cables, etc., are prescribed, also the quality and sufficiency of all machinery, materials and workmanship, restoration and repair of streets, conformity to future improvements, etc. Rates are prescribed, and it is provided that the rates shall be the same for the same amount of service to all consumers, and that the lighting service shall be metered if the consumer so requests. Special contracts for heating schools and auditoriums of all sorts are provided for. Form and method of presentation of bills is prescribed, also testing of light meters and fee therefor. The late special session of the Illinois state legislature established an optional commission form of city government, which, when adopted by a city, prohibits discriminations in rates for any purpose or to any cunsumer unless expressly authorized by enumeration in a city ordinance. The following section is of particular interest:

"Section 12. Either party shall have the right to have either or all of the above and foregoing rates revised and determined after sixty days' notice to the other, but not oftener than once in five years, during the existence of this grant, but it is expressly agreed that no changes in the maximum rates hereinbefore established or to be hereafter established shall be made by said company, without the consent of the city council of the city of Taylorville, expressed by ordinance duly passed and approved, and no changes shall be made as herein provided until after a period of five years.

"If either party shall give notice as herein provided for a change in the maximum rates and the said city of Taylorville and the said company fail to agree upon what shall be taken and held to be a proper maximum charge for electric current for light, heat and power, or steam heat, or either of them, the same shall be submitted to a board of engineers consisting of three disinterested electrical engineers, to be selected by the city and by the company, in such manner as may be mutually agreed upon, but no one of whom shall be considered, nor be a representative of the interests of either the city or the company, which said board of arbitration shall investigate the question of the reasonableness of the charges contained in said notice, and make a report thereof to the city council and said company, which said report shall be binding upon the parties thereto, as to the reasonableness of the charges submitted to such board for investigation and report.

"And should such board find that a change should be made in such maximum charge or either or any of them, the city council shall, by proper ordinance, fix the maximum charge for electric current for light, heat or power or steam heat, or any or either of them, as found by said board of arbitration, which said maximum charge for such electric current and steam heat shall be and remain the maximum charge for such electric current and steam heat, for the period of five years next succeeding, and until it is changed as herein provided, and the costs and expenses of such arbitration shall be borne in equal parts by the said company and the said city of Taylorville. And both the city and said company shall render such aid and assistance to said board of arbitration as they require to enable them to reach a decision with regard to the rate or rates under consideration.

"Provided, however, that such board of arbitration shall not take into consideration the value of any franchise granted by the city of Taylorville to said company, or to any person, persons, company or corporation, and owned or controlled by said Taylorville Railway, Light, Heat and Power Company, its successors or assigns, in considering the reasonableness of the rates charged by said company."

It is provided that the company shall furnish free current for lighting the public library, city hall, fire department building and water works pumping station, and street lines therefor, the city to furnish the fixtures within the buildings, also space on poles and in conduits for city fire and police alarms and telephones, which use is non-transferable. A street lighting contract is also included, fixing rates and measure of quality for such service.

The franchise is not exclusive. It includes the usual clauses indemnifying the city for all sorts of damages from construction, operation and maintenance, and forms of bond therefor and for failures in service, or other violations of the terms of the franchise.

It is also provided that there shall be no assignment or transfer of the franchise to any one else engaged in the same business in the city. The term of the franchise, in accordance with Illinois law, is twenty years, at which time the company is required to remove its poles, wires, etc., from the streets, unless a new franchise is granted by the city council.

The other franchise referred to is one for the water works of Mexico, Mo. This franchise is also for a term of twenty years. It provides for a system of water mains as shown on an official map, for furnishing water for the citizens through the mains, for water for fire protection through seventy-eight fire hydrants to be paid for at the total rate of $3,120.00 a year, for future additional hydrants at $50.00 a year each, for additional intermediate hydrants at the cost of furnishing and moving them, for reservoirs and wells and purification of water, for a water tower, buildings and machinery, extensions of mains, fire streams, rates, telephones and fire alarms. The city is given water free for its public offices, a hose house, seven public drinking fountains for man and beast and one in a park and for flushing sewers, each flush tank to discharge not oftener than four times in twenty-four hours. The ordinance contains the following provisions of special interest:

"Section 15.—Failure of Supply. If at any time the supply of water as hereinbefore stipulated is shut off from any cause whatever (except through the fault of the city) the rental of the fire hydrants shall cease during such suspension. If at any time the grantee shall fail (except through unavoidable accident, or providential hindrance) to furnish an adequate supply and quality of water as provided in this ordinance, the city may impose such reasonable penalties as it may deem the situation justifies, such penalties, however, to be subject, on the grantee's demand, to review in the courts before enforcement.

Section 17.—Purchase by City. The city shall have the right to acquire by purchase all the property of the grantee actually used and useful for the convenience of the public, at any time after the expiration of fifteen (15) years from the passage and approval of this ordinance by public vote, upon giving one year's notice to the grantee, and upon paying therefor in cash the then cost of duplication, less depreciation, of said property, with ten per cent. additional thereto as compensation for earning power, franchise value, going value, contingencies, and all other intangible values of every nature whatsoever. If the grantee and the city should not be able to agree upon the cost of said duplication, less depreciation, they shall select a disinterested and competent appraiser to make such valuation. If the said parties cannot agree upon such appraiser, then the city shall select one appraiser, and the grantee shall select another appraiser and the two appraisers so selected shall make the valuation. If they cannot agree upon such valuation, then they are to select a third appraiser, and if they cannot agree upon a third appraiser, said third appraiser shall be selected by the judge of the circuit court of Audrain county, Missouri. Thereupon the appraiser, or appraisers, so selected shall ascertain by majority vote the then cost of duplicating said property, less depreciation. Such appraisal shall be binding upon both parties, and the city shall thereupon have the right to purchase the said property at such appraised value, plus ten per cent., as above stipulated."

It is, of course, impossible for a city council in an ordinance of this nature to produce the same effect which it is possible for a state public service commission to produce in the regulation of service and of rates, but the Taylorville ordinance makes a strong effort in this direction, and if it will call to its aid experts who can determine the reasons for failures of the company to fulfill its obligations and the best methods of making the necessary improvements, it can go far toward keeping an unwilling company within bounds. There is no ambiguity regarding the character, quality and amount of service required, so that a company intending to give good service knows exactly what is required of it. The only penalty provided for failure to comply with the terms of the ordinance, other than assessment of damages arising from construction or operation, is revocation of the franchise, a step so serious that it will scarcely be taken unless the company is extremely derelict in the performance of its duties.

The provision for revision of rates,

quoted in full above, is a step in the right direction, but has one or two rather serious defects. One of these may prevent the revision. If the parties fail to agree upon a method of appointing the board of engineers there is no method of forcing the submission of the question to such a board or of securing its appointment. The party objecting to a change of rates can thus defeat the revision by simply refusing to agree to any proposition for the appointment of the board. It is questionable whether the restriction of the membership in the board to electrical engineers is wise unless the term is construed in a rather large sense and may be considered to include competent engineers or others with sufficient knowledge of the electrical problems involved to make them available for the service. Most of the questions involved are not, strictly speaking, within the province of the electrical engineer, as such, although their application to the work in hand may require some knowledge of the technique of electric lighting practice. The provisions governing the appointment of the appraisement board for the sale of the water works plant at Mexico, quoted in full above, are more completely applicable, so far, at least, as the method of appointment is concerned. It remains to be seen whether the provision requiring both city and company to furnish such aid to the board of engineers as they may require will give them the authority to call for books and records enough to get the complete knowledge of the plant and its operation which is necessary if the most equitable rates are to be determined.

It is interesting to compare the provisions in the two ordinances regarding intangible values. The Taylorville ordinance provides that no allowance shall be made for the value of the franchise in determining the reasonableness of the rates changed by the company. The Mexico ordinance combines earning power, franchise, going value and contingencies in one item, which it arbitrarily fixes at ten per cent. of the cost of duplication of the plant, less depreciation. In these items are usually found the excuses for excessive capitalization, the preliminary estimates of value of franchise, growth of business and the like, giving color, from the promoter's standpoint, to the issue of capital stock to represent them. Franchise value without doubt belongs to the community whose growth gives the value and the increase in value which is so large a part of the promoter's stock in trade. Going value and earning power depend upon the competence of the management and upon its ability to take advantage of all the opportunities to develop business. They may very properly be considered as belonging to the company and, if their values can be determined, they should be credited to the company. The process of determination of these values is one requiring the most expert investigators, which very few cities, and practically no small cities, can afford to employ, even if the officials know where to find them "with no strings to them." The Mexico franchise solves the difficulty by fixing definitely the percentage to be allowed for them all. The Taylorville franchise reduces one very properly to zero and leaves the determination of the others to the board of engineers. This is one reason for doubting the propriety of excluding from that board experts on the financial side of the question because they cannot be classed strictly as "electrical engineers."

The Taylorville franchise provides no definite method of determining the extent of violations of the contract included therein. The Mexico franchise provides, as quoted above, for reference of the matter to the courts in case the imposition of penalties by the city for violations is considered by the company to be unjust.

These franchises have the advantage over the one presented for discussion last year in that they are both in operation. They contain some of the same provisions. That form of franchise was accepted by the most interested party, the company, but was not adopted by the city council, mainly for reasons not connected with the technical features of the franchise. It carries these modern phases of franchise building still farther than the examples here quoted. Reference may be made to the paper by the author on "A Modern Franchise for a Public Service Corporation" in the proceedings of the society for 1909.

The best such franchise is, however, merely a substitute, it is to be hoped for temporary use, for control by a state public service commission. Legislatures have found it necessary to limit the period of franchises to 20, 25 or other longer periods of years because they were confessedly unsatisfactory and there seemed to be no other way of holding them in check. Such limitation for a business which is by nature continuing is wasteful, and results in rates high enough to

pay, not only the legitimate charges for operation, maintenance, interest, etc., but also an additional sum to equal the risk that the plant must be abandoned when the franchise period has expired. The state commission is able to get around this difficulty if it has the power to grant permits for operation of franchises for indefinite periods, during good behavior, or until conditions so change that changes in the terms of the franchises must be made. It would be a very exceptional city which could undertake the same procedure. No cities except the largest have the experts necessary to establish a public service commission in every city, as was proposed in the bill offered in the Illinois legislature last winter. Fortunately these provisions were cut out of the "Commission Form" law which was passed. The state can employ these experts and keep them sufficiently employed in the oversight of the public service corporations in the state to retain them permanently in its service. The state commission is more nearly independent of local conditions than any commission appointed by the local authorities can be. It owes no allegiance to either party. The state commission is therefore the logical result of the agitation for more thorough supervision of public services, whether operated by municipality or by private company. Until a state has such a commission it cannot expect to secure much better results than can be attained under such a franchise as that granted by Taylorville.

The Municipal Lighting Plant at Bellefontaine, Ohio

THERE are several cities, notably of the west or middle west, that own one or more of their public utilities. Bellefontaine, Ohio, has the distinction of owning and operating an electric light plant, a gas works, and a water works; all three being under the management of the mayor and board of control. Of the public utilities mentioned, the electric plant presents more features of interest because of the fact that it is now meeting problems of great concern to all municipal lighting plants, and for the reason that its power equipment is a demonstration of a type of unit comparatively unknown in municipal lighting.

As is usually the custom where municipal ownership is comparatively untried, Bellefontaine in making provision for the accounting system of the plant did not fix any charge for street and public lighting. This fact makes it exceedingly difficult to arrive at a definite conclusion concerning the financial success of the plant entire. The cost of the power station, including engines, generators, switchboard, foundations and auxiliaries, was $44,000 at the time of completion in May, 1906. The cost of reconstruction of the transmission line and of 150 street arcs brought the entire first cost to about $60,000.

The following is the annual report for the year 1909:

EARNINGS.

From incandescent lighting	$10,953.61
From power service	1,821.60
From public service (estimated)	13,925.52
Total	$26,700.73

DISBURSEMENTS.

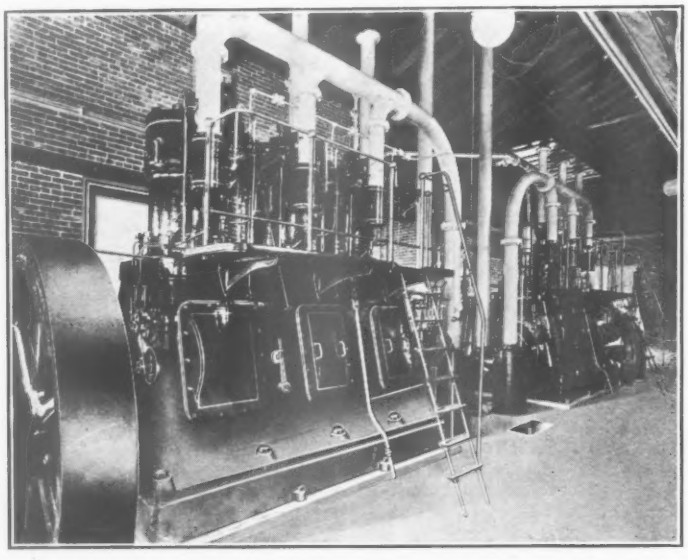
Fuel oil	$1,850.07	
Waste, packing and supplies	39.31	
Engineers	2,100.60	
Expense of machinery	1,182.05	
Extra labor	28.84	
General expense of manufacture	54.13	
Total expense of manufacture		$5,255.00
Insurance		15.00
Carbons	$207.89	
Attendance	730.42	
General expense and labor	414.93	
Expense of public service	$1,353.24	
Carbons	$25.21	
Attendance	78.35	
General expense and labor	702.75	
Total expense commercial service	$806.31	
Total expense of distribution		2,159.55
Poles, lamps and wire	$179.45	
General expense and labor of construction	30.37	
New public service	$209.82	
Poles, lamps and wire	$454.44	

Transformers and meters	1,560.26	
General expense and labor of construction	132.27	
Appliances and tools.	11.25	
New commercial service	$2,158.22	
Extension to building	$75.00	
Paid board of sinking fund trustees for redemption of bonds	3,000.00	
Total capital account		$5,443.04
Total disbursements for year	$12,872.59	

these two gives a total of $12,775.21. The earning capacity of the plant and its success as a municipal venture can not be arrived at definitely from this, but figures are available which show the economy of operation of the power factors.

The power plant equipment includes two 225 h. p. Diesel oil engines of a speed of 164 r. p. m., and two direct connected 150 kw. a. c. generators. An accompanying photograph shows the installation.

The Diesel engines are radically different from other types and are perhaps not sufficiently familiar to be



OIL ENGINES IN MUNICIPAL ELECTRIC LIGHT PLANT,
Bellefontaine, Ohio.

Total receipts for year		$12,641.05
Balance in treasury Jan. 1, 1909		2,426.26
Balance in treasury Jan. 1, 1910	2,194.72	
	$15,067.31	$15,067.31

Number of customers.....345
Gained during year..... 60
Number meters, both power and light.339

As will be noted, the item "Public Service" under earnings is merely estimated, and the basis on which this estimate is made is not given, so that the information is of little value. Then under the caption "Total Receipts for the Year" the amount, $12,641.05, is given without any information as to its source. It is evidently not derived from the earnings from the two sources "From Incandescent Lightning" and "From Power Service," for the sum of

passed by without further comment. They are three-cylinder units, of the vertical enclosed-crank-case type, direct-connected to the generators. Their method of operation distinguishes them from all other types of engines. Air is admitted into the cylinder and compressed to a pre-determined pressure, which will give a temperature above the firing point of the fuel. The fuel (either crude or fuel oil) is then blown by air from a separate compressor into the cylinder at the time when the compression is complete. This spray of fuel is ignited by the highly-heated air within the cylinder and burns steadily with no essential rise in temperature. The resulting impulse delivered to the piston is therefore steadily applied and is not delivered with a shock, as is the case

with most methods of ignition in internal combustion engines.

The air compressor is of standard construction, and can be driven by the engine or by separate power. It serves only to pump the air for oil injection and to store a surplus in tanks for starting the engine when cold. A small pump, mounted on the engine, lifts the fuel into the atomizing chamber in quantities regulated by the governor, which proportions the fuel supply to the load. The lubrication of all parts within the crank-case is taken care of by oil splashed over them by the revolution of the crank webs. A forced-feed oiler and a few cups complete the system.

The two engines described have been in service in Bellefontaine continuously since May, 1906. From that time until March 1, 1910, the saving in fuel alone, estimating the coal consumption at 9 pounds per kw. hour, has been $29,500; while the maintenance expenses have been very light and the entire power-house force required was three men (one night engineer, one day engineer and one helper, who also trims the lamps).

As will be seen from the annual report given above, the total disbursements for production, including fuel, maintenance, repairs, labor, etc., amounted in 1909 to $5,255. The total kilowatt output was 645,740 kw. hours, so that even with the items above noted the cost of production was only about 4/5 of a cent per kw. hour service delivered. The total amount of fuel oil consumed was 755,281 gallons. The cost of fuel oil was only $1,850.07, or 0.28 of a cent per kilowatt hour on switch board.

The Bellefontaine plant presents many features of interest to one interested in municipal ownership, and it is to be regretted that full information, which is usually so freely offered under similar conditions, is not available in this case.

A GOOD MACADAM ROAD.

EDITORIAL COMMENT

Asphalt Paving Specifications.

The Decision in the Peoria Electrolysis Case.

Road Surfaces to Suit the Traffic.

ASPHALT PAVING SPECIFICATIONS.

The doctors seem to disagree upon the standardizing of asphalt paving specifications quite as much as upon wooden block and concrete paving specifications. The specifications as adopted by the Organization for Standardizing Paving Specifications were given in MUNICIPAL ENGINEERING, vol. xxxviii, p. 234. On another page of this number will be found the objections of one chemist to some of the principles on which these specifications are based; also the report of F. P. Smith for the sub-committee on asphalt paving specifications of the American Society of Municipal Improvement, which, while following the former specification in some details, is materially different in others, and is built, in some respects, upon a different principle.

Mr. Perdue would reduce the specifications for the asphaltic constituents of the pavement to ductility, viscosity and penetration. But at the same time he compares the making of asphalt specifications to the making of cement specifications, wherein the major part of the requirements are purely physical and not chemical. He seems to forget that the cement industry went through the same periods of adherence to chemical requirements and naming of certain acceptable cements as standards of quality that asphalt is passing through, and that at the present time the chemical test is demanded by the most acceptable specifications for every cement whose origin and process of manufacture has not been proven to be correct by years of use. The cement industry has not yet entirely passed this period, but the chemists have reduced the probable sources of materials for making cement to such definite substances that, for the ordinary engineer who is simply insuring the receipt of material up to an acceptable standard, the question of chemical composition seldom arises. If he has a perfectly safe specification, however, it has the chemical requirements for use when circumstances demand.

Asphaltic materials have so many different sources that it has not been so easy for the chemists to eliminate themselves entirely and reduce the tests of asphalt safely to the physical tests alone. In the writer's early experience but one kind of asphalt was specified for pavements, partly because no one outside the companies promoting its use, and probably no one inside, knew enough about either chemical or physical tests to feel safe in including asphalts from other sources, or to feel sure they knew how to manipulate other materials of different constitution in making paving mixtures. One of his earliest tasks in taking the duties of city engineer was to find an asphalt which could be used in competition with the standard. Chemical theories were so crude that they had to be thoroughly tested by experience before they could be confidently accepted. The new material was acceptable, and has been one of the standards ever since. This led the way for other materials, good, bad and indifferent, which have met with varying degrees of success, according to their qualities and the expertness with which they were handled. Every conceivable method of testing was tried before the present methods were developed. And the chemists generally do not yet feel safe in cutting so completely loose from the chemical tests as our Kansas City correspondent would have them, though they are approaching each year nearer to physical tests as the practical standards of

quality after the particular brand or mixture of brands of asphalt to be used in the particular pavement has been decided upon.

There is equal difference of opinion regarding the binder course, most pavement builders, however, finding some such method of connecting foundation and wearing surface necessary for the best results.

Neither the standard specification nor that of Mr. Smith states the purpose of the mixture of sizes of aggregate in wearing surface to be the inherent stability of the mineral aggregate. The standard in particular follows rather closely the old empirical formula, while Mr. Smith gives an opportunity, through his allowable variations in percentages of sizes to produce the highest possible stability, or the lowest percentage of voids. That the latter method of procedure produces excellent results with larger sizes of maximum sized particles has been proved by Mr. Warren. That it should be valid for an asphalt pavement wearing surface, as Mr. Perdue maintains, seems reasonable. Mr. Perdue, however, states that the voids may be reduced to 25 per cent., but in the same paragraph prescribes 10 to 10.5 as the percentage of asphaltic cement to be used, which apparently does not fill the voids.

These details are still subjects of discussion and others of our readers may be willing to express themselves regarding them.

Mr. Smith has attempted to arrange the specifications in a more logical order than they are in the standard set, and differs in some details besides those mentioned above. It is to be hoped that the committees of the two organizations, which have several common members, will be able to agree upon a form which will embody the good features of both these sets of specifications. It would be unfortunate if two sets of specifications should be presented by two bodies of municipal engineers as standards. The confusion would be increased rather than diminished. It is hardly probable, however the duplication of membership in the two societies being so great, that they would put themselves in the position of the major in charge of the army post, who carried on an official controversy with himself as post quartermaster over the furnishing of certain supplies.

THE DECISION IN THE PEORIA ELECTROLYSIS CASE.

The suit of the Peoria Water Works Company against the Peoria Railway Company to stop injury to its pipes by electrolysis by stray currents from the street railway lines, has reached the stage of a preliminary decision. A report in MUNICIPAL ENGINEERING for 1901 of the recommendation of the Master of Chancery deputized to take evidence states his opinion that the street railway company should be required to install a double trolley system. This report was not acted upon until 1908, when it was again referred to the same Master of Chancery for further investigation. He made a second report in 1909 in which he reached the same conclusion as in the first. This report is now taken up by the judge, A. L. Sanborn, of the U. S. Circuit Court for the Northern District of Illinois, and he has made a decision in the case which differs materially from the recommendation of the Master in Chancery.

In the ten or twelve years since the case was first put under investigation, there has been great advance in our knowledge of the facts of electrolysis, and it is now possible, through co-operation of the corporations interested, to reduce the danger of damage to a minimum.

The court recognizes these facts; and, while deciding that the street railway company should be enjoined from continuing its injury to the water mains, it makes the condition that the water company co-operate with the street railway company and that reasonable time be given for making the improvements. Costs of the proceedings are divided between the two parties.

It seems to have been shown by the evidence that the area in which dam-

age occurs is not large and is located in the vicinity of the power house, and that the most economical and satisfactory results have been obtained by co-operation of the two systems interested. Who shall pay the expenses of the work is not yet decided, but apparently it is the street railway company. Details will be worked out when a decree is applied for in compliance with the general conclusions of the judge's decision as to the general principles involved.

The first difficulties of this nature were between the telephone and street railway companies. In these cases the street railways were first in the field, and it was possible by proper construction for the telephone companies to protect themselves at a cost, particularly for new construction, far below that necessary in revising street railway construction to prevent interference.

In the present case the water company was first in the field, and the same is doubtless true of many other cases in water, gas, conduit and other underground lines. But, now that all these various uses of the underground space under city streets are established, and it is a matter of chance as to which comes in first; and it is possible to protect largely against damage from construction by future companies at low expense, if the first design and construction are properly made, the courts are coming to recognize equality of rights of all these companies without reference to priority in any particular city. So, while the greater part of the burden may be laid upon the later arrival, as in the Peoria case, the duties of the other company are recognized.

In one sense the decision is a victory for the street railway company, since the whole burden and cost is not laid upon it, as was thought possible and perhaps equitable when the suit was first started, and the water company is instructed to co-operate in the work of improvement. It may also be considered a defeat for the water company to this extent, because it could very properly claim that it could not be expected to foresee the effect of the construction of a street railway system which was not invented or was in its infancy when the water company's pipes were laid. But the street railway has most of the work to do and will probably be required to pay nearly if not quite all the expense, so that on the water company will fall only the burden of helping in the task of keeping the relations of the two systems in safe condition.

The opinion of Judge Sanborn is eminently sane and practical, and should serve to clear up the numerous similar problems that have been waiting for this decision.

ROAD SURFACES TO SUIT THE TRAFFIC.

The course of road and street construction is shown by articles in this number of MUUNICIPAL ENGINEERING from the top-soil roads of Georgia to the latest improved sheet asphalt pavement for city streets. There are many forms of road and street surfaces all the way between and beyond, perhaps in both directions. It is the duty of the engineer and road official to select that which will be of most value for the particular conditions of each case.

The top-soil road described in one article is apparently well suited to the infrequent travel on the roads in the Georgia county in which they have been developed, and to the low value of the lands and low tax rates and bonding abilities available. They lift the farmer out of the mud and enable him to haul larger loads along the roads. Apparently the result of the treatment given the roads is a rather low quality of gravel road, sufficiently impervious to shed water falling or draining upon it, and thus conserving the bearing power of the natural soil. Evidently the road must be well drained or the sub-soil must be as impervious to the absorption of water as is the improved surface. The better roads thus obtained will aid in the improvement of conditions, increase the value of land and consequently the taxing and bonding ability. So,

when the top-soil road is outgrown it will have produced the value necessary to pay for its replacement by something better. This is true economy.

Continuous repairs will prolong the period of efficiency of such roads and add to their economy, at the same time that comparison of the cost of this repair with that of better roads will ultimately aid in the demonstration of economy of replacing the top-soil roads with better roads when the time comes for further improvement.

The unbiassed observer will perhaps not enter fully into the enthusiasm of the author of the paper, who is the developer of the road, but will rather be disposed to warn other road officials to study thoroughly the economy of the construction and the adaptability of the available materials before adopting it for any of their own roads.

On a somewhat higher plane the Indiana gravel roads have been constructed at a cost some three or four times as great, and they have very largely aided in the widespread advance in the profits of agriculture and consequent general advance in value of farm lands. In that state the advancement has reached the period when still better main roads are demanded, and now strong efforts are being made to establish a state road system under an expert highway commission which can confidently be expected to build the best roads which the demands of traffic and economy of construction and maintenance demand.

The construction of these comparatively cheap gravel roads has been fully justified by the results; and now that the time for better roads has come, the main roads can be replaced by the modern types of wearing surfaces without throwing away valuable road material, while the less traveled roads can be kept up to the demands of the traffic on them by a constant and consistent system of road repair under the expert guidance of the commission.

What these new roads shall be built of, whether tar or asphalt macadam, bitu-mass, bitu-mineral, bitulithic, asphalt, brick, concrete, or even wood, must be determined by the expert commission after a careful study of the conditions for each road, if the best and most economical results are to be attained. All failures of road construction are due to four causes, which really reduce to one; they are poor material and workmanship in construction, neglect of maintenance, excessive cost of construction or maintenance, all of them really dependent upon the choice of the proper method of construction and maintenance to fit the particular road. It is not surprising that there are so many failures in road building, for the roads are so seldom planned by experts. Some even of the state roads have been failures because those in charge of them were not so expert as they were supposed to be. The activity in promoting new materials and methods for road construction has been very great in the past five or ten years and some real experts have developed, and the number of competent road engineers is increasing with some approach to the rate of increase in the demand for them.

If the fitting of the character of the road to the demands upon it is fully considered in design and construction, we will have economical roads as well as better roads, and the good work will be popular. If fixed standards are imposed without reference to local conditions, expense of construction and maintenance will be in excess of benefits, and a reaction will set in. During the present dearth of competent road designers and constructors the economic results desired can be expected only if the work is under the direction of a central state commission with power to enforce its decisions upon the technical and economic problems involved.

THE QUESTION DEPARTMENT

Life of Wooden Water Pipe and Spacing of Bands.

I beg you to give me some information regarding the use of machine banded wooden pipe for a gravity drinking water system.

The diameter will be six inches, and the length of the pipe will be 14,600 feet, and divided as follows:

8,150 feet to withstand a head of 50 feet.

5,150 feet to withstand a head of 75 feet.

1,300 feet to withstand a head of 100 feet.

What I would like to know is, how the life of wooden pipe compares with steel riveted in the local soil, which contains a certain amount of alkali.

What formula is generally used to determine the diameter of the spacing between the wire? E. P., Maxwell, N. M.

A summary of a discussion by the American Society of Civil Engineers and a collection of data from other sources are given in MUNICIPAL ENGINEERING, vol. xxxvi, p. 239, and a little additional information is on p. 243. The points of particular interest in connection with the above questions are that the staves must be kept wet, and that a gravity line should have a head of about 50 feet to insure this; that filling round the pipe should be free from organic matter or growing tree or other vegetation roots; that the head should not be more than 150 to 200 feet. Clay and loam which are free from vegetable matter are recommended for use as filling around pipe. No information is given as to the action of alkaline soils, but it is recommended that the effect of the local soil on wooden pipe be carefully studied, also its effect on steel pipe or cast-iron pipe. References to previous articles are also given. There is a brief general article, illustrated, on wooden pipe conduits in vol. xxxix, p. 13.

The formulae for determining size and spacing of bands are given in Turneaure and Russell's "Public Water Supplies" ($5), also a table giving dimensions of staves, bands, etc., for pipe more than 10 inches in diameter. To determine the size of band, the safe strength of the band is taken as equal to the safe pressure per lineal inch of band multiplied by the radius of the exterior of the pipe. The safe pressure per lineal inch of band, using a factor of safety of 4, depends on the crushing strength of the wood and the area of the contact of the band with the wood, which is assumed from observation to be equal to the radius of the band for safe compression of the wood by the band, and is assumed as 650 times the radius of the band. This equation gives the radius of the band as equal to the stress on the band divided by 650 times the radius of the exterior of the pipe.

The spacing of the bands is derived from a similar equation and equals the total safe stress on the band used in the previous equation, divided by the water pressure plus the swelling force of the wood when wet. The water pressure is equal to the pressure per square inch due to the head, mutiplied by the internal radius of the pipe. The swelling force of the wood is equal to 100 times the thickness of the staves. All dimensions are in inches and pounds.

The two equations must be used together and the computations modified until reasonable results are obtained for both.

The table gives for a pipe 10 inches in diameter the stock sizes for staves as 1½ by 4 inches, the thickness of finished staves as 1 1-16 inches, the economic sizes of bands as 5-16 by 7-16 inch oval cross-section, the safe working stress in band as 1,255 pounds and the consequent factor of safety of 5.26. This leaves only the spacing to be determined by the latter formula given above for the maximum head at the point for which the computations are made.

Information About Hydrant Rentals.

I want to get articles in MUNICIPAL ENGINEERING about hydrant rentals.
S. H. L., New York City.

The following articles in MUNICIPAL ENGINEERING will be of particular interest in connection with this subject:

In vol. xxxvi: A part of the article on "Water Rates" on p. 212.

In vol. xxxv: Hydrant rentals in a number of cities and a brief statement of the principles which should underlie their determination are given on p. 31. Another statement of these principles is given in an article on "Water Rates and Rentals" on p. 73.

In vol. xxx: Some hydrant rentals in the smaller cities are given on p. 306.

In vol. xxviii: A fair discussion of the basis for fixing hydrant rentals and the rentals charged in some seventy cities will be found in an article on p. 464 entitled "What Would Be a Fair Basis for Fixing Water Rates for Fire and Domestic Service."

In vol. xxvi: The question of deductions from hydrant rentals for lack of

pressure is considered, with references to court decisions, on p. 23.

In vol. xxiv: Perhaps the most practical discussion of the subject of hydrant rentals is that on p. 182 when supplemented by the article on p. 189.

In vol. xxiii: The location of hydrants and incidentally its effect on renfals is sketched in an article on "Hydrants, Meters and Wastes" on p. 185.

In vol. xxi: Two decisions on cases for collection of hydrant rental are given on pp. 94 and 95.

In vol. xv: A number of rates for fire hydrants are given on p. 235.

Cost of Cast Iron Pipe.

Would it be possible for you to ascertain for us quotations of cast-iron water pipe during the years 1904 and 1905?
I. C. S., Waverly, N. Y.

The New York quotations on cast-iron pipe per gross ton, given monthly, were as follows, the first figure, where two are given, being for 6 to 10-inch pipe and the latter for larger pipe: January to July, 1904, both inclusive, $28 and $27; August, $25.50 and $25; September to November, $25 to $25.50 and $24 to $25; December, $26 for 6 to 10-inch; January, 1905, $26.50; February and March, $26.50 to $27 for 6 to 10-inch; April, $26.50; May, $28 to $28.50; June, $28; July to September, $27; October to December, $27.50.

During the same period bids were received and contracts were let in various cities in New York and Pennsylvania at the following prices, presumably per net ton, the figure being either the contract price or the lowest bid in case contract was not reported let:

February, 1904: Auburn, N. Y., $22.60 for 12-inch pipe; Philadelphia, Pa., $30 per net ton for 3 to 48-inch pipe, although one bid was $24.40; Reading, Pa., $25.66. March, 1904: Newark Valley, N. Y., $23.50 for 4-inch, $23.40 for 6-inch and $23.25 for 8-inch pipe; Philadelphia, Pa., $33 for 16 and 24-inch, $33.50 for 20-inch pipe. April, 1904: Yonkers, N. Y., $24.40 per gross ton for 18-inch pipe. June, 1904: Hudson, N. Y., $22.35 for 6 to 18-inch pipe. September, 1904: Wallkill, N. Y., $22.50 for 4 and 6-inch and $22 for 8-inch pipe; New York city, $25 for high pressure pipe. October, 1904: New York city, high pressure, $26.50; for standard water pipe, $22.50. November, 1904: New York city, standard water pipe, $23.50 for one contract and $24.50 for another; Troy, N. Y., $22.85 for 6 and 12-inch pipe. January, 1905: New York city, standard pipe, $25; high pressure, $29. April, 1905: Oswego, N. Y., $26.70. July, 1905: New York city, $26.50. August, 1905: New York city, $24.95. September, 1905: New York city, $26.75 and $27.50. October, 1905: New York city, $27.50. November, 1905: New York city, standard, $27.50; high pressure, $38. December, 1905: New York city, $30, $29.30 and $29.50.

The monthly quotations are for delivery at tidewater, New York. The bids and contract prices are for delivery, usually f. o. b. cars, at the place named.

Steel Sheet Piling for Well of City Water Supply.

Our water works water supply is a large well 20 feet deep in coarse gravel. For a special reason it is desirable to sink a hole in the bottom, say 6 feet in diameter and 10 feet deep. Allow me to ask your opinion of setting up metal sheet piling in a circle of required diameter to drive and excavate inside of it. I conceive that this excavating may be done by sand pumping for the finer material and loading the coarser by hand with scoop and tongs under water the object being to keep the main well in service during the work, the well being pumped to its lowest limit continuously to permit the work. The piling being drawn, would it be feasible left in as permanent curb? The well is arch-covered with about a 2-foot manhole for entrance of materials and work. A drilling rig might be used to facilitate work. C. V., ———, Ohio.

The plan is certainly feasible if the details are properly handled. The piling can be kept as the permanent curb if protected from rust, or if a concrete or brick wall is built to take its work before it rusts enough to be in danger of giving way.

Will our readers report their experience in this use of sheet piling for the benefit of our correspondent and many other readers?

Efficiency of Gasoline and Alcohol Engine.

Will you kindly advise me whether an engine made for kerosene, gasoline, alcohol and other fuels is as efficient and satisfactory as an engine run by gasoline only? Which is the more reliable and least troublesome? W. L., Jeffersonville, N. Y.

The natures of the fuels used in internal combustion engines are so different that in general they require very different treatment to produce the most economical results. The dimensions of cylinders must even be changed for some of them. The fact that the same engines have been used for different fuels has given use to considerable misinformation regarding their relative economies. It does not seem possible, therefore, that an engine made for all fuels could be as economical as one designed particularly for the use of one of them. With but one or two exceptions these statements are applicable to the use of any of the fuels in an engine designed for any other one of them.

The reliability and freedom from trouble of any engine is a matter of design and care rather than of the fuel for which it is designed. The development of the automobile has given the gasoline engine a precedence in perfection of design which it is difficult for the others to meet.

Can our readers report details of their experiences in case they have had opportunities to compare the various fuels used in internal combustion engines?

Makers of Electric Rock Drills.

I am in the market for an electric rock drill for ordinary quarry work. Is there such a thing on the market that is a success? Our stone crusher is operated by electricity, and I want to save the first cost of buying an electrically operated air compressor to run the drill if it is possible to do so. We run but one drill.

D. F. M., St. Albans, Vt.

There are numerous makers of electric drills for all kinds of work, such as the Marvin Electric Drill Co., Binghamton, N. Y., Jeffrey Manufacturing Co., Columbus, O., the General Electric Co., Schenectady, N. Y., the Westinghouse Electric and Manufacturing Co., Pittsburg, Pa., which are applicable to quarry work. Will our readers add to this list, which is limited to those with which the writer is personally acquainted?

Eastern Installations of Septic Tanks and Contact Beds.

This town contemplates the installation of a sewage disposal plant, and, on account of limited space to erect the same, together with soil conditions, generally bordering on hardpan, I have thought best to study the septic tank and contact filter system. Will you be good enough to give a list of such plants in operation in the east, so that we can make a personal inspection of them in operation?

A., Town Engineer, ———, Conn.

The line of demarkation between septic tanks and settling tanks is not always sharply drawn. Many of the tanks in use are settling rather than septic tanks. The following list includes both: Andover, Brockton, Clinton, Gardner, Hopedale, Leicester, Marlboro, Southbridge, Westboro, Worcester, Mass.; Pawtucket, Woonsocket, R. I.; Waterbury, Conn.; Ballston Spa, Ithaca, Lancaster, Liberty, Mt. Vernon, Olean, Saratoga Springs, N. Y.; Plainfield, Rutherford, N. J.; Allentown, Altoona, Hanover, Washington, Pa. Of these, Hopedale, Mass., the New York and New Jersey plants may most of them be considered to be septic tanks. Contact filters are not numerous in this country. Ballston Spa and Lancaster, N. Y., Plainfield, N. J., Pawtucket, R. I., Allentown and Hanover, Pa., are eastern examples.

Prevention of Odor from Septic Tank Effluent.

In what manner can the effluent from a septic tank be filtered or disposed of so as to prevent bad odors. The effluent is retained somewhat too long, the septic tank being too large, and can be run into a body of water, not large enough to dilute the raw sewage, the purity of which does not matter. Prevention of odor is of first importance.

A. W. K., ———, Ill.

Some of the odor can be eliminated by reducing the dimensions of the septic tank. If it is too deep this can be done by filling with some compact material, leaving the proper volume, but not reducing the depth unduly. If it is too wide, a partition can be put in and the space behind the partition filled. If too long, the same can be done, preferably at the inlet end, leaving a channel for the incoming sewage to reach the tank. This filling can be taken out later when the increase in amount of sewage requires it.

The effluent from the tank can then be discharged into the body of water so that it will not be exposed to the outer air until it has been mixed with the clean water. If the body of water is a lake or pond, the effluent pipe should discharge its sewage some distance from the shore, and it may even be necessary to give two or more outlets, so as to distribute the odorous water somewhat. The odors will then be absorbed by the water of the pond and will produce little or no nuisance. If the water is in a stream, it may not be so easy to insure that the end of the effluent pipe will always be covered and the water at that point be kept moving, but this condition should be approached as nearly as convenient.

Size of House Connections to Sewers.

I have a discussion with a local plumber concerning the size of sewer pipe to use for house connections. I take the stand that nothing smaller than 6-inch should be used, but he says 4-inch is large enough. I would be very glad to know what is used in eastern towns.

J. W. B., ———, Okla.

For residences of almost any size even a 4-inch pipe is larger than is absolutely necessary to carry the house drainage. It is large enough to carry roof water also, provided the roofs are not of excessive area, and also provided it can be laid at the usual minimum gradient of 1 in 40. Assuming no storm or roof water in the house connection, it must be kept clean by the flushes from closets, the discharges from bathtubs and sinks, which are all intermittent, and some very brief. The gradient of 1 in 40 is sufficient to give a flushing velocity to the discharge, and the amount of the discharge is sufficient to fill a 4-inch pipe full enough to flush out any ordinary solid matter. If the pipe is 6 inches in diameter it is too large for most of the intermittent discharges to do their full duty in moving stranded solids, for the water will be shallow and its force will be diminished, even if its velocity is kept up. This is the explanation for the statement, said to be based on observation, that 6-inch pipes used in house connections have more stoppages than 4-inch pipes.

The course of reasoning followed above might be used to reduce the house connection to 2-inch diameter, but for the fact that many discharges contain solid matters which would jam in a 2-inch pipe and stop it up completely. The 4-inch pipe is therefore better than either the 2-inch or the 6-inch.

Similar reasoning applied to the street sewers in a separate system, and similar observation, lead to the adoption of 8-inch

pipe as the minimum size rather than 6-inch or 10-inch.

If storm water is admitted to the house connections, their size must be computed for the maximum flow of such storm water from roofs, areas, etc. But even here, the size must be kept down to the smallest possible to carry this maximum flow without back water or overflow, because in the intervals between storms the intermittent discharges from the house system must be depended upon to keep the pipes clean.

Municipalities Operating Garbage Reduction Plants.

Will you kindly send us a list of municipalities operating their own garbage disposal plants, those who reduce their garbage and make fertilizer, etc., not incinerating plants.

F. D. C., Cleveland, O.

The only cities in the above class known to the writer are Cleveland and Columbus, O.

The cities of more than 30,000 population which collect their own garbage and turn it over to a contractor for reduction are New York, Chicago, Boston mainly, Detroit, Cincinnati in part, Rochester largely, Toledo part reduced and part burned, Syracuse in part, Dayton, O., Wilmington, Del., in part, New Bedford, Mass., in part, Troy, N. Y.

The cities in which garbage is collected and reduced by contractors are Philadelphia, Baltimore, Pittsburg, San Francisco in part at present, but will change to municipal incineration soon, Washington, Newark, N. J., Indianapolis, Ind., Omaha, Neb., Paterson, N. J., Reading, Pa., Bridgeport, Conn., Utica, N. Y., Dubuque, Ia., York, Pa. Vincennes, Ind., is practically the only smaller city having a garbage reduction system. It is operated under contract.

Specifications for Sidewalks, Concrete Mixing, Inspectors' Reports.

1. What is considered the best practice in machine mixing, with batch mixer? Required, for instance, the necessary number of revolutions of drum per batch, after the last unit of material enters the machine, and before any portion of the concrete is discharged.
2. What would be reasonable output of good concrete from a 9-cubic-foot Smith mixer on sidewalk work, loading with barrows and dumping into barrows, 8-hour day.
3. What is considered good practice in sidewalks construction as to
   a. Depth of walk (concrete).
   b. Depth of wearing coat.
   c. Size of sand grains or small gravel in finish coat.
   d. Expansion joints (maximum range of temperature, 150 deg. F.)
   e. Preparations for concrete and wearing coat.
4. In machine mixing are any dry turns required? That is, any revolutions of drum before water is applied?
5. In hand mixing, sidewalk and curb work, number of turns required dry and wet.
6. Is it good practice to use unscreened gravel in sidewalk work? Required size of aggregates in sidewalk and curb construction.
7. Have you any data on inspectors' reports for street paving, sidewalks, curbs, etc.?
8. Do you recommend compression tests on concrete to be used in sidewalks?
9. Do you know of any abrasive or rattler tests on concrete cubes, to determine wearing qualities of concretes of different materials or preparations? Would you recommend such tests?

You will see that my questions are presented in a rather disconnected form. The points I wish covered are of vital importance to this city.

J. N. E., ———, Mont.

1. The designs of batch mixers vary so much that no general rules for handling them can be given. Each mixer must be studied and experimented with until the best results are obtained, and the program producing these results should then be adopted. In general, the materials should be mixed until the mass attains a uniform color and appearance as to mixture of sizes. Opinions differ as to the order of procedure, and it must differ somewhat with the nature of the aggregates. The experiments with the mixture should cover this ground. Some mixers produce as good results with four or five turns as others do with twice as many. Uniformity in product is the requirement, and the order of insertion of materials and number of turns wet and dry must be such as to produce this result.

2. The maximum capacity of a 9-cubic-foot Smith mixer is said to be 20 cubic yards mixed per hour, which would be at the rate of one batch per minute. This supposes sufficient force to keep the machine filled promptly and instantaneous dumping. If the dumping is into barrows, which must be filled one at a time, there will be considerable delay, and the capacity of the plant may thereby be reduced to perhaps 9 or 10 cubic yards an hour. Idle time must also be allowed for, and the amount may easily be reduced to 6 or 7 cubic yards an hour. In other words, the management of the work and of the men is quite as important an item as the maximum capacity of the mixer. Perhaps our readers will give us some figures from their own work on this subject.

3. The standard specifications for cement sidewalks of the National Association of Cement Users have the following provisions:

a. Minimum thickness of pavement, 4 inches in residence districts, 5 inches in business districts; making thickness of base 3¾ inches minimum in residence districts and 4 inches in business districts.

b. Minimum thickness of wearing coat, ¾ inch in residence districts, 1 inch in business districts.

c. Fine aggregate is used in the top coat, consisting of sand, crushed stone or gravel screenings, graded from fine to coarse, passing, when dry, a screen having ¼-inch diameter holes, preferably of sili-

cious materials, clean, coarse, free from loam, vegetable or other deleterious matter, and not more than 3 per cent. shall pass a sieve of 100 meshes per linear inch.

d. The provision regarding expansion joints is that "in every 50 linear feet of walk, at least ½-inch expansion joint shall be provided. Any means which will provide this will be accepted." Joints entirely through the slab are also provided for. This question is considered at some length in the November number of MUNICIPAL ENGINEERING, vol. xxxix, p. 385.

e. For the base the proportions of materials should be such that the cement shall overfill the voids in the fine aggregate by at least 5 per cent. and the mortar shall overfill the voids in the coarse aggregate by at least 10 per cent. The proportions shall not exceed 1 part cement to 8 parts fine and coarse aggregates. When the voids are not determined the concrete shall be composed of 1 part cement, 3 parts fine aggregate and 5 parts coarse aggregate.

The proportions for wearing surface are 1 part cement and not more than 2 parts fine aggregate.

4. This is considered in paragraph 1. Five to fifteen turns may be required, according to design of mixer and character and condition of materials. There is much difference in practice as to time of application of water, and it is usually applied in the most convenient manner, preferably not all at once, but in such manner as to produce the most complete mixture and not wash the cement out of a mixture already partially made.

5. The standard specifications require that in hand mixing the ingredients of the concrete shall be thoroughly mixed dry, sufficient water added to obtain the desired consistency, and the mixing continued until the materials are uniformly distributed and the mass is uniform in color and homogeneous. The number of turns wet and dry will depend on the tools used and the manner of using them. Three times careful turning dry of the materials, as measured out, with a cement layer of uniform thickness on top, ought to be sufficient, and an equal number after the water has been added. If not enough, more should be required, and if the workmen are expert enough so that less will produce the result, the inspector may reduce the number of turns, with reservation of right to change when necessary.

6. A natural mixture of sand and gravel suitable for the base is sometimes found. If the inspector keeps watch of it and sees that it conforms in composition with the mixture above prescribed, there can be no objection to its use. The inspector should exercise great care in accepting such natural mixtures.

7. The "Forms for Daily Force and Material Reports," given in MUNICIPAL ENGINEERING, vol. xxxviii, p. 270, will give some valuable suggestions, though they are not directly applicable to the reports of inspectors. "Cost Keeping for Engineers," p. 340, and "Cost Keeping on Municipal Contract Work," vol. xxxvi, p. 1, are also valuable. A daily report form for street work will be found in vol. xxxiv, p. 239, intended for keeping track of city labor and teams, but may help in making the form desired in this case. A suggestive article on "Forms for Keeping Cost of Public Work" will be found in vol. xxxiii, p. 250. A list of previous articles on city engineer's office records, including field notes, is given in vol. xxxii, p. 18. The one applying most clearly in the present case is one on "Loose Leaf System for Field Notes and Office Records," in vol. xxx, p. 409, which gives forms for inspectors' note books on several kinds of work. They could be used with but little modification under any ordinary circumstances.

8. The writer sees no particular advantage or information to be gained from compression tests on samples of concrete for use in sidewalks. The quality of the concrete depends so much on the method of laying that a test on one block may not represent any other block on the work. Close inspection of the construction is of much more value than tests by compression.

9. The writer knows of no comprehensive rattler tests of concrete cubes. Such experiments as have been made have not given indications of value enough in the tests to induce experimenters to continue them. Again, workmanship is a governing condition. Undoubtedly hard materials in the aggregates will give more durable wearing surfaces for walks or roadways than soft materials, provided the other conditions are the same. It is quite common to require granite or other hard stone in the fine aggregate used for wearing surface of sidewalks where traffic is heavy. This is not necessary for walks on residence streets.

Street Improvements for Oregon City.

We are planning to improve our streets with about seventy-five blocks of hard surface paving this next season. Any special information concerning this feature of municipal improvements which it might come in your way to impart I will be pleased to receive.

L. L., Mayor, ———, Ore.

Reference may be made to the following articles in the current volume of MUNICIPAL ENGINEERING, which are directly applicable to the case of a small growing city:

"Brick Pavements in Rochester, N. Y.," p. 20; "Street Railway Track Construction in Brick Street," p. 30; "Filler for Brick Pavement," p. 31; "Sufficiency of Brick Specification," p. 32; "Cost of Brick Paving with Granite Curb," p. 33; "Remedy for Slippery Pavement," p. 33; "Cost of Asphalt and Bitulithic Pavements," p.

113; "A Little Bituminous Filler Story," p. 118; "Grooved Wooden Block Pavement on Steep Grade," p. 119; "Fond du Lac's Cement Streets," p. 136; "An Official Inspection of Brick Pavements," p. 138; "The International Good Roads Congress," p. 171; "Bituminous Roads, Mixed and Poured," p. 178; "Brick Highways in Ohio," p. 182; "Ordinance Requiring House Connections Before Paving Begins," p. 201; "Pavement Crowns," p. 212; "Action of Bituminous Expansion Joints," p. 212; "Expansion Joint in Concrete Pavements," p. 213; "Calcium Chloride for Dust-Laying and Road Maintaining Purposes," p. 214; "Street Paving in New Orleans," p. 260; "Wooden Block Pavement Tests in Minneapolis, Minn.," p. 265; "Work Preliminary to Road Construction and Street Pavement Maintenance," p. 270; "Brick Roads at the International Road Congress," p. 276; "The Concrete and Macadam Streets of Richmond, Ind.," p. 281; "Cement Streets of Fond du Lac, Wis.," p. 284; "Crown for Brick Street," p. 292; "Bituminous Filler Again," p. 294; "Concrete Pavement in Delphi, Ind.," p. 294; "Tar Macadam Test Road," p. 295; "An Expansion Joint Form," p. 296; "Cost of Maintaining Asphalt Streets in Brooklyn," p. 314; "Convict Labor on Roads," p. 315; "Sidewalk and Curb Grades," p. 354; "Bituminous Pavements, Patented and Otherwise," pp. 358 and 361; "Pavements of Erie, Pa.," p. 364; "Supervision of Municipal Work," p. 368; "The Economies of Modern Highway Engineering," p. 374; "Specifications for Expansion Joints in Cement Walks," p. 385; "Relative Action of Calcium Chloride and Oil on Stone and Gravel Roads," p. 392; "The Ohio Experiments on Road Binding Materials," p. 401. Also the articles in the current number. These articles cover practically the whole paving field and the same will be found to be true regarding any volume of MUNICIPAL ENGINEERING. Our correspondent, who is a new subscriber, is therefore recommended to watch the current numbers and to avail himself of the bound volumes as he finds it convenient.

Standard Forms of Books for City Offices.

Please advise me where I can procure the best kind of a record book for the use of the city clerk, also a complete set of books for the city water commissioner, including meter reading books, as well as the consumers' register and ledger. It would be well, if you have blank pages of any or all of the above books, to forward same to me, or advise me where I can procure them. I would like also to get hold of a good form of blank book for the recording of licenses issued.

S. C. H., ———, Neb.

The duties of city clerk differ so much in different states, and even in different cities in the same state, that no general form of book can be devised. The same is true, though to a less extent, regarding books for recording licenses.

Will our readers supply forms which they have found convenient? They will be published for the benefit of our correspondent and others interested.

As regards water works records, the American Water Works Standard Bookkeeping System, published by MUNICIPAL ENGINEERING COMPANY, Indianapolis, Ind., is complete and convenient. It was developed from the forms in use in several water works plants, and includes the best features of all of them. Circulars and sample sheets are sent on request. It covers all the accounts mentioned above.

The Public Accounting Departments of such states as Ohio and Indiana have forms of books for keeping municipal, county and township accounts, which can probably be secured upon application.

The article on "Bookkeeping for Metered Water System" in MUNICIPAL ENGINEERING, vol. xxxviii, p. 183, will be of much interest in this connection.

Vacuum Street Cleaning Machine.

In your issue of November, in the Question Department, you refer to vacuum street cleaning machines. I am very much interested in same, and would be glad to know where I can secure descriptive matter of the Furnas cleaner, which you say has long since demonstrated its success. F. L. J., Chicago, Ill.

The new Furnas automobile cleaner is ready for demonstration, but no printed matter concerning it is yet available. McMeans & Tripp, 710 Majestic building, Indianapolis, Ind., are the mechanical engineers building the machine, and will respond to all inquiries.

Information About Franchises for Public Utility Corporations.

This city is in need of information pertaining to granting of franchises by the city to public utility corporations, such as telephone companies, gas companies, street railway companies, etc. Can you give us any information as to where a book or books treating upon these subjects can be purchased? We are in touch with the publication, "Municipal Franchises," by Delos F. Wilcox. Is there any better?

C. R. BEARDSLEY, City Engineer.
Corvallis, Ore.

The book referred to is the only general treatise on the subject.

The three volumes of the report of the National Civic Federation on "Municipal and Private Operation of Public Utilities" have much of value in this connection. They can probably be obtained at the office of the Federation, 281 Fourth avenue, New York City.

The annual reports of the Railroad Commission of Wisconsin, which has charge of most of the public service utilities of the state, are also mines of information.

MUNICIPAL ENGINEERING has a number of articles on the subject which are directly applicable to the present case. One of these is that entitled "Some Provisions in Modern Franchises for Public Service

Corporations," on another page of this number. The principles underlying public service franchises are discussed in an article in vol. xxxviii, p. 335. Another on "Principles Underlying a Street Lighting Contract' will be found in vol. xxxv, p. 96, and "A Modern Municipal Franchise" is described on p. 306.

In vol. xxxviii, pp. 317 and 340, are articles on percentage of receipts and other forms of compensation for street railway franchises which may be of interest in this connection. One on p. 335, on "Co-operative Franchises for Municipal Public Service Corporations," is of direct application. It refers to an article giving in full the terms of such a franchise proposed for a water company, which is printed in vovl. xxxvi, p. 247, and to a similar franchise proposed for a telephone company which has been printed in the proceedings of the American Society of Municipal Improvement and of the Indiana Engineering Society. Another article in vol. xxxviii, directly applicable to this case, is that on p. 393, "Factors That Should Be Considered in Making Street Lighting Contracts." Two on rates, on pp. 417 and 419, may also be consulted.

Fair Deal for Contractor.

Where the commissioners of a county have advertised for bids for the construction of bridges according to plans and specifications of an engineer appointed by said board of commissioners, has the said board of commissioners the right to reject a bid, though it be one-fourth less than the one granted the contract?

Is there any law governing the engineer in regard to making an estimate on work to be let by the commissioners of a county? For example, an engineer makes an estimate of $330 for a 4-foot arch 28 feet long, stating it contains 25 yards and concrete is worth $12 per yard, when it does not contain 25 yards and should cost not to exceed $6 per yard; another example: a 36-foot common I-beam bridge is estimated to have 18,000 pounds of steel at 5 cents per pound; all of which shows fraud on its face; all these facts show something wrong.

Where the whole set of commissioners, engineer and bridge company are working together in this way, and seem to have a perfect understanding, in what way can another contractor get a fair deal? I mean, bring them to terms.

E. C. W., Linton, Ind.

Publicity seems to be the only remedy for such conditions. Ultimately the State Board of Accounts should be given full power to enforce publication of all financial transactions in public offices in form readily understandable. When transactions are to be public in every sense, attempts at fraud will be discouraged. Pending the development of such legislation, the only course is to make public such transactions in some other way. A suit for injunction to prevent the letting of contracts in the manner described would be one way of procuring this publicity, care being taken to secure full reports of the progress of the case. Unfortunately, such suits do not always result in securing the injunctions. The court decisions attribute so much power to exercise their discretion to public officials that, unless fraud or violation of law is very definitely proved, judges are very apt to decide that the course of procedure followed by such public officials is within their rights and so cannot be interfered with. If such officials were certain that every doubtful transaction would be shown up, even by an unsuccessful suit, they would be careful at least to keep within the letter of the law.

Where to Obtain Street Scrapers.

Could you advise me where I could obtain a device drawn by horse to scrape mud from streets, I have seen such a device advertised, but cannot remember where. My recollection is that it is similar to a horse-power hay rake, with a hoe at the end of each steel spring, which scrapes depressions as well as level surfaces. It impressed me favorably when I saw it.

S. W. H., City Engineer, ———, Conn.

Names of makers of street scrapers which can be used for the purpose named will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings, "Contractors' Tools and Machinery," "Graders," "Plows," "Road Machinery," "Road Plows," "Scrapers," "Scraper Blades," "Street Contractors' Supplies," "Street Scrapers."

Where Can Oil Fulfilling Standard Wood Block Paving Specifications Be Obtained.

The sub-committee of the American Society of Municipal Improvement on wood block paving specifications recommended a preservative oil of at least 1.10 gravity at a temperature of 38 deg. C., and that the distillate shall not exceed 2 per cent. up to 150 deg. C. and 35 per cent. up to 315 deg. C. In fact, the specification covering the oil is fully as severe as the tentative specifications adopted at Chicago by the Organization for Standardizing Paving Specifications.

I ascertained the names of the members of the committee and wrote them a letter, calling their attention to the above specification, and concluding: "You further state that investigation on your part has shown that this oil is not controlled by one company, and I assume by this statement that you also assert that this oil is not controlled by allied interests of one company. You also state that it is easily obtained by any one, not only in this country, but abroad and in Canada. In view of the fact that I have canvassed this country, as well as foreign countries, for a delivery of 100,000 gallons of this oil, and found that it cannot be obtained, I must have omitted in my request the manufacturers whom you state can furnish this oil. Will you, therefore, kindly forward me the names of parties in this country, foreign countries and Canada who are manufacturers of this oil, and who have the capacity to furnish it in large quantities, from 50,000 to 200,000 gallons, in a reasonable length of time after the order is placed?"

Up to the present time I have not received a reply from any of the gentlemen on this committee; therefore, I believe it

is safe to assume that they did not know where the oil to the specification recommended by them could be obtained, as without doubt, members of any committee of a technical body, recommending a certain oil and stating positively that it could be obtained, would have been glad to give the information requested by a manufacturer, especially when a stamped envelope was inclosed for reply.

M., New York.

The sub-committee report referred to in the above communication was prepared by a single member of the committee after arrival at the convention, and was presented as such, and, in common with the other reports of sub-committees on paving specifications, was referred for further consideration to the general committee on standard specifications, and was not adopted by the society. There was some confusion as to the membership of committees which was not cleared up, so that the failures to reply to our correspondent's letters may have been due to the lack of information on both these points on the part of those to whom the letters were addressed.

The duties of the committee on standard specifications and its relations to the work of its sub-committees were more definitely outlined after the confusion attending the presentation of their reports, and their work will undoubtedly be better co-ordinated in the future.

Our correspondent's letter is published practically as received, because the writer had a similar difficulty in ascertaining sources for obtaining the oil specified by the Chicago convention, by private inquiry, and therefore presents the letter with request that our readers send us such information as they can give, that the matter may be cleared up. Our correspondent's name is not given, but he is a manufacturer who uses quantities of oil such as he mentions. Replies will be forwarded to him as received.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Asphalt, Asphaltic Macadam and Bitulithic Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We notice on page 344 of your November issue what you say regarding the discussion of bitulithic pavements at the Erie convention of the A. S. M. I., printed on pp. 358 to 363. In the main this is excellent, but there are two points upon which I feel sure that I could convince you that your impressions are erroneous.

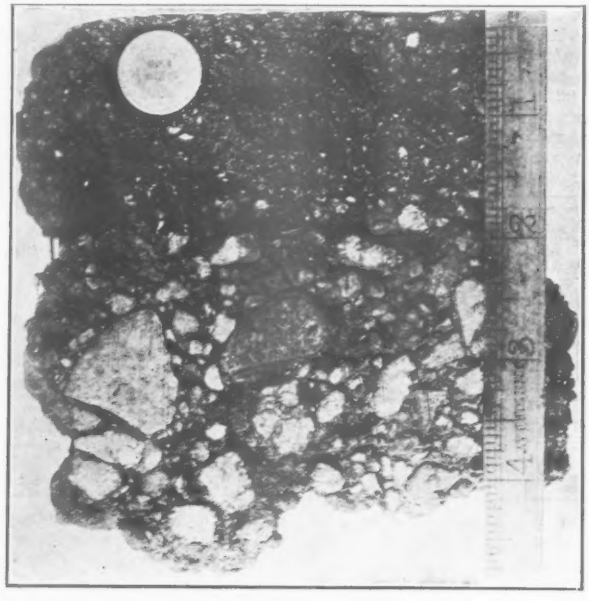
First—That the pavements referred to by Mr. Kingsley are very far from "strict adherence to the principles on which the bitulithic pavement rests." In fact, they are all entirely dissimilar from the bitulithic pavement. Your sentence from which the above is quoted indicates not only that the differentiation is very narrow, but that I so conceded it, when, as a matter of fact, the difference is very broad. For instance, all of the so-called bituminous concrete laid in Denver, to which Mr. Kingsley refers, was merely a bank gravel mixed with asphalt *as a foundation*, with a 2-inch wearing surface of standard asphalt sand mixture.

An examination of the samples Mr. Kingsley presented at Erie, as you state, bears out our contention that the surface is sand mixture originally laid 2 inches thick, and the foundation a mixture of gravel and asphalt. There are a few spots in Denver where the sand mixture is entirely worn off and the gravel mixture now exposed, but there is evidence that the pavements, when laid, had a 2-inch sand surface, and that Denver never laid any work with mixture of crushed stone or gravel in the wearing surface I regret that we cannot spare from our files samples showing this, but I am having made and will send you in a day or two a photograph of a cross-section sample further proving this fact.

Regarding Pittsburg, I am sending you small samples of the Lang avenue, Pittsburg, pavements, and the so-called asphaltic concrete pavement laid at Wellington, Kan. Examination of these pavements will clearly show you that they are substantially asphalt pavements with a very little fine crushed stone, substantially a standard asphalt pavement with no similarity to bitulithic, and absolutely mis-named "Asphaltic Concrete."

Second. You state, referring to discussion with Mr. Fred Warren, that you "are disposed to think that Mr. Warren did conceive the idea of the bitulithic pavement on account of his experience

with the Denver pavements." I am very certain that you are mistaken in this, and that in all the talks that I had with him during the preliminary development he never referred to the Denver pavements. Of course, it is possible that in a general way the weakness of the Denver work had some effect on his thought just as the weaknesses of asphalt pavements and the weaknesses of the tar macadam pavement, as laid in Hamilton, doubtless had an effect on his mind, and that the final thought which developed in the patent of a bitulithic pavement was the outgrowth of his experience and observation of all pavements.



SAMPLE OF DENVER ASPHALTIC PAVEMENT.

GEO. C. WARREN,
Pres. Warren Brothers Co.,
Boston, Mass.

1. Mr. Warren will readily be pardoned by our readers for desiring a full understanding of the conditions of the pavements for which claims of anticipation of the bitulithic patents have been made, and for wishing the editorial comments, to which he refers, to be as clear as possible. His statement may be taken as an amplification of the editorial statement referred to, for the writer can see no essential difference between the two. Practically all the samples shown approached the appearance of that shown in the accompanying photograph. One Denver sample, referred to in the aforesaid editorial comment, had the general appearance of having been a mixture of the materials used in both bottom and top, for the larger stones were scattered all through it. They were not numerous nor large enough, nor were the voids small enough to meet the patent requirement of inherent stability of the aggregate, and it is quite possible that the top surface had been worn off. However, there was more fine material than shown in the foundation in the photograph, and there were few stones of the size of the larger ones shown. One swallow does not make a summer, and one sample out of many taken to defend an infringement suit only emphasizes the departure of the others from the specifications of the patent, as well as showing its own lack of compliance therewith. The sample referred to approximated closely the general appearance of the samples from the Kansas and Iowa cities which very evidently are "lacking in strict adherence to the principles upon which the Bitulithic patents rest," though similar in appearance to the inexperienced eye.

2. Mr. Warren is to be commended for defending his brother's originality, in which the writer fully concurs, as shown in the editorial comment referred to. Mr. Warren's Denver experience helped lead him to the bitulithic pavement idea, not because he copied anything he saw there, but because he saw the defects of the Denver mixtures as he saw those of the pavements then called tar macadam. In the search for a cure for these defects he developed the mixture of sizes to produce an aggregate with inherent stability and the other attributes of his pavement. This

was the writer's understanding of his discussions of the matter with Mr. Fred Warren, and this is a little more definite statement of the fact given in the aforesaid editorial comment.

Cement Concrete Vats and Tanks.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Impervious, odorless, tasteless and sanitary vats and tanks for buttermilk, wine, oil, pickles, sauerkraut, etc., can be constructed of reinforced concrete, the reinforcing to be designed by a competent engineer, provided the interior surfaces are treated as follows:

After the forms are removed, grind off with a carborundum stone any projections due to the concrete seeping through the joints between the boards. Keep the surface damp for two weeks from the placing of the concrete. Wash the surface thoroughly and allow to dry. Mix up a solution of 1 part water glass (sodium silicate), 40 deg. Baume, with 4 to 6 parts water, total 5 to 7 parts, according to the density of the concrete surface treated. The denser the surface the weaker should be the solution.

Apply the water glass solution with a brush. After four hours, and within twenty-four hours, wash off the surface with clear water. Again allow the surface to dry. When dry, apply another coat of the water glass solution. After four hours, and within twenty-four hours, again wash off the surface with clear water and allow to dry. Repeat this process for three or four coats, which should be sufficient to close up all the pores.

The water glass (sodium silicate) which has penetrated the pores has come in contact with the alkalies in the cement and concrete and formed into an insoluble hard material, causing the surface to become very hard to a depth of ⅛ to ½ inch, according to the density of the concrete. The excess sodium silicate which has remained on the surface, not having come in contact with the alkalies, is soluble, therefore easily washed off with water. The reason for washing off the surface between each coat and allowing the surface to dry, is to obtain a more thorough penetration of the sodium silicate.

It is obvious that concrete surfaces so treated, if hard, impervious and insoluble, have been made impervious, tasteless, odorless and sanitary.

ALBERT MOYER, Assoc. Am. Soc. C. E.,
New York City.

Effect of Ground Water on Concrete Piles.

A test of the effect of ground water on concrete piles from which the casing used in driving the piles was withdrawn before the cement had set is afforded by the work on the new sewerage system of Louisville, Ky. The report of the engineers, J. B. F. Breed, chief, and Harrison P. Eddy, of Boston, consulting engineer, treats of the matter in connection with the building of an outlet structure down the bank of the Ohio river.

The contractor had already made an arrangememnt with the National Concrete Construction Company for the driving of reinforced simplex piles designed for the foundation of the drop chamber, and this arrangement was continued by the sewerage commission. These piles are about 20 feet in length and were driven through strata of sand, gravel and clay. The lower and last piles driven apparently met a very hard substance, which was supposed to be broken or partly disintegrated slate. The casing for these piles was 16 inches outside diameter and was driven with cast iron points. After reaching the required depth and approved penetration, the reinforcement and concrete were put in place and the casings withdrawn. A current of ground water passing by the piles had been thought to injure them by the washing away of the cement of the concrete. The current of the water as it appeared on the surface in the lower part of the trench was colored by the cement, immediately following the disturbance of the solid around the concrete by the withdrawal of the casing. Chemical analysis of the water also showed the presence of cement, within a very few moments after drawing the casing. Examination of three of the completed piles after they had attained hard set, indicated that they had been but very little affected by the ground water, and as the size of the simplex pile was much larger than the size required in the design of the sewer, their use appeared to be satisfactory.

Exclusive Rights of Water Franchise.

The borough of Brushton, Pa., by an ordinance passed in 1891, authorized the Pennsylvania Water Company to construct and operate a water works within the borough limits, and granted the said corporation the use of the streets of the borough for that purpose. The water works company complied with the terms of the franchise granted and proceeded to construct its plant and lay its mains. The grant for the right to use the streets of the borough was without a time limit.

In 1894 the city of Pittsburg annexed the borough of Brushton, assuming all contracts and obligations existing and valid between the borough of Brushton and other persons, firms or corporations.

In May, 1908, the city of Pittsburg claimed the right to extend its own water works system into the annexed borough, then the Thirty-seventh ward of the city. Thereupon the Pennsylvania Water Company filed a bill to restrain the city from proceeding farther. An injunction was granted, which, on hearing, was made perpetual.

It was held that where a borough grants a franchise to a water company and contracts for a supply of water, it cannot undertake to supply the water itself.

MUNICIPAL ACTIVITIES

Chicago City Hall—Austin Abattoir—McKinley Bridge—Oklahoma City Water Supply—Auto Fire Engine—Motor Fire Apparatus

Quality of Construction in Chicago City Hall.

Acting under the direction of the bureau of public officials, and as a result of a complaint from a bricklayer on the work, a board of experts was employed to investigate the construction of the Chicago city hall. This committee consisted of Mr. James Hollis Wells, of New York City; Prof. A. N. Talbot, of the University of Illinois, and Mr. A. J. Hammond, engineer for the bureau of publicity.

The report of Mr. Hammond summarizes the results of this investigation. An abstract of this reports is as follows:

I have found as a result of this investigation that some of the charges made by Mr. Coulson, particularly those pertaining to the concreting of the steel columns around the light courts and the spandrel filling of floor beams on some floors were substantiated, and also that some of the other exterior columns and spandrel beams were not properly protected with concrete.

I have also found that he was in error concerning the lack of brick backing in the granite columns and the lack of concreting around the steel columns inside of these granite columns, at least of the three examined, as these conform to the contract. The capital of the granite column in the county building, which was said by Coulson to have been hollow, when opened was found concreted, and the mortar, which was said to have been poor, was found to be of good quality.

Other charges made as to inferior floor tile, lack of concreting over the windows, and the straw lining in the party wall of the county building, were not substantiated.

Of the charges made, the most serious were the ones concerning the lack of concrete covering of the steel columns and beams, as this covering is of importance, not only from the standpoint of fire-proofing, but to protect the steel from corrosion. The practice of protecting steel by applying concrete directly to the structural steel was recommended three years ago by the National Board of Fire Underwriters, was called for in the city hall specifications, and should have been carefully done.

The further investigation has disclosed that the steel column at the northwest corner of the building was not properly concreted on the sixth floor, but on the seventh floor was well concreted. Also, at the southwest corner of the building the lower flange of one of the spandrel beams was exposed. While the entire structural steel was not examined, there were not enough instances noted where concrete was omitted to justify further cutting. It is also the fact that where openings were made the metal was found to be painted.

The book tile of the saw-tooth skylights had been whitewashed in place of being plastered, and the structural steel of the saw-tooth skylights had not been fire-proofed. The contractor has started this work. The plastering in general was of good quality and workmanship and conformed to the specifications.

Some of the Botticini marble used, particularly on the vault floor, was found defective. Quite a number of chipped and broken pieces of ashlar and capping in wainscoting and piers were found, which had not been condemned. This condition prevailed to some extent on the second and third floors. These defects were marked for condemnation by the architects at the time of our inspection.

Some of the Italian marble wainscoting and counter in the water-pipe extension room on the fourth floor, and the election commissioners' room on the third floor, were badly matched, and not equal to the sample submitted, but were found to have been already marked "condemned" by the architects.

The cabinet work on some floors was found to show a number of defects, some due to manufacture, others due to carelessness in packing and shipping, but the architects stated that the defective trim had been condemned. The mahogany jambs of the corridor doors had been tightly set up, and as the building was damp, some of the jambs had swelled and warped. This condition was due to the lack of being able to get heat into the building at the proper time, on account of the steam piping being concreted, a matter clearly due to carelessness, as all the fine cabinet work in the building was being subjected to extreme conditions.

The defects have, fortunately, not been very extensive and indicate to some degree careless workmanship, but more particularly they point to the lack of careful and efficient inspection and supervision. The inspectors state that they did not know that the steel columns were not concreted, nor that the steam pipes were concreted in solidly at the floor levels, or that rubbish was left here and there on floor arches, but ample provision had been made by the city for unusually careful inspection, and the character demanded the best talent available. This remark refers especially to the men who were employed to remain constantly on the work. The general superintendents and engineers are high-class men, but they had not given sufficient time to check their personal representatives on the work.

In general, this investigation has shown that some of the charges made were true, but more have not been substantiated. Other defects have been discovered, and in numerous places material was found which had been already condemned. Most of the defects can be easily remedied, and these have already been made good in many cases by the contractors.

It must be recognized as a pertinent fact, in such a large structure as the new city hall, that some work may be slighted by careless workmen, and will have to be corrected, that inferior stock and materials will be furnished, and these must be condemned, and the specific instances which have been pointed out are comparatively small when the building is taken as a whole, and indicate the ordinary skimping which frequently occurs in

contract work. There is no evidence so far as disclosed of any general and determined effort to skin the job.

Austin Contemplates a Municipal Abattoir.

A $10,000 municipal abattoir, after the plan of the one now in operation at Paris, Tex., is in the minds of the city administration of Austin, Tex. The need of a place where the meat used by the residents of Austin could be slaughtered under sanitary conditions is being strongly urged, as local conditions are said to be unsatisfactory. With this plant the city would control the fattening pens as well as the slaughter pens, and would keep them outside of the city limits or away from the residential part of the city.

The plant of Paris, Tex., is the one the city would adopt, as it is being taken up over the country. The plant would not make money; it is not the ambition of the city to make money, but it would be self-sustaining. At a charge of $1.25 for every beef and 75 cents for every sheep, hog, calf or goat, the city would be slaughtering the animals, rendering the tallow and producing "tankage" cheaper than any of the local butchers could do the same thing. The refrigerating plant would charge 10 cents per day for every animal left there longer than five days. The tallow would be sold to the laundry men and soapmakers at 5½ cents per pound, while "tankage," the residue, would be sold as a fertilizer for $23.50 per ton or mixed with grain and sold as chicken feed.

The Paris plant was described in MUNICIPAL ENGINEERING, vol. xxxix, p. 90.

The McKinley Bridge.

The formal opening of the McKinley bridge, across the Mississippi river, at St. Louis, occurred November 10. The completion of this bridge marked an important point in the development of interurban railroads west of the Mississippi.

The Illinois traction system came into the control of Congressman McKinley in 1900, being at that time but six miles in length, connecting Danville with Westville. It now operates over 500 miles of railway, connecting Danville, Urbana, Champaign, Decatur, Clinton, Bloomington, Peoria, Lincoln, Springfield and St. Louis. The lines in the north now extend from Princeton through Peru, Ladd, Marseilles, Spring Valley, La Salle, Streator, Ottawa and Morris. The twenty miles between Morris and Joliet will be completed soon, and from there it is planned to build the line into Chicago. A contemplated connection from Streator to some point on the Illinois traction system will give a through line from Chicago to St. Louis, and a western line will no doubt be built in the near future.

This system is not an interurban in the general sense of the term, but an electrically operated railroad, doing all classes of freight and passenger business, even operating sleeping cars.

The McKinley electric bridge was begun in November, 1907. It cost $4,500,000, is the largest bridge ever constructed to carry an electrically operated railway line, having a greater carrying capacity per lineal foot than any other bridge crossing the Mississippi. The steel structure includes three immense spans across the river, 521, 523 and 521 feet, respectively. In addition, there are two river spans of 250 feet each and three shore spans of 150 feet each. Steel elevated approaches form the connecting links at each end.

The approach on the Missouri end passes over twenty-four acres of freight yard owned by the Illinois Traction Company. The total length of bridge and approaches is over 8,000 feet. The main bridge carries two railroad tracks, while two roadways 14 feet wide are carried outside on cantilever brackets. The design of the bridge was prepared by Ralph Modjeski and F. E. Washburn was the resident engineer.

Test of Auto Fire Engine in New Bedford, Massachusetts.

The new Webb auto engine was officially accepted by the city council committee on fire department following a test, during which the machine pumped 800 gallons per minute—100 in excess of the contract stipulation. The test took place in front of engine house 10, in the presence of Chief E. F. Dahill, Aldermen Kerwin and Glennon and Councilmen McCarty and Charles W. Jones. The engine made a rapid run up to engine house 10 on Purchase street, and was connected with two 100-foot lines of hose, with which the pressure at the engine was kept at 120 pounds during the entire test. Two 200-foot lines were then tried and the pressure was kept up with these also.

Comparative Cost of Motor Fire Apparatus.

The fire chief of St. Louis gives figures on cost of maintaining auto fire engine as against horses on the first two months. The first cost of equipment is $600 greater for the auto than horse-drawn vehicle. The total cost of the auto for the first two months, with 117 runs, is $24.22 for gasoline and oil, and no other expenses. The cost of the horse-drawn apparatus corresponding would total $163.22, which is over six times as much.

Oklahoma City's Water Supply.

Oklahoma City, Okla., has grown by such leaps and bounds that the present water system is thoroughly inadequate to meet the present or prospective future demands of the city. Designed several years ago for a maximum capacity of 3,000,000 gallons, the growth of the city has been so abnormal that the present water consumption is between 7,000,000

and 8,000,000 gallons, and the present source of supply has been taxed to its utmost. Besides this, the character of the water from the present source of supply is thoroughly unsuited for domestic and manufacturing purposes. Mr. Alexander Potter, of New York City, has been retained to investigate the entire question of a suitable supply for Oklahoma City, which has a population of about 65,000, and his commission includes the investigation of such sources as will be suited for the city when it reaches a population of 200,000.

Many suggestions have been offered for the solution of this problem, among them one for bringing the water by gravity from the mountains of New Mexico. There are two distinct problems to be worked out in Oklahoma City: one a plan for insuring a proper supply for the immediate needs of the city, and the actual work be undertaken forthwith. The second is to devise a scheme that will be satisfactory for the city and will not retard the growth of the city should it continue to increase in population in the future at a rate approaching its rate of growth during the past decade.

MUNICIPAL AND TECHNICAL LITERATURE

Toronto City Engineer—City Magazine—Municipal and State Reports

The Toronto Engineer's Report.

The annual report of the city engineer of Toronto, Canada, is a very comprehensive, though compact, statement of the work undertaken and finished during the year 1909. Tables, maps and diagrams are used extensively in the publication. The latter, in particular, are extremely valuable.

In the diagram showing the classification of pavements different colors are used to represent the various kinds of pavements, and their relative prominence may be noted at a glance. Diagrams representing the relative merits of different brands of cements under the various tests are also given, and are greatly superior to tables requiring time and study for their comparison.

Another feature of the report is the account of work in the bridge department. The failure and repair of the lower chord of the Queen street bridge and the summary of impact tests on the Dundas street bridge are indicative of the care and thoroughness characteristic of the entire engineering department.

Municipal and State Reports.

The fifty-ninth annual report of the bureau of water of Albany, N. Y., in addition to a number of tables of costs, quantities, etc., of materials used, has an account of the experiments on double filtration at the city plant. The experiments are recounted in detail, and a number of tables are given summarizing the results.

The report of the Bangor water board for 1910, in addition to the usual data on pumping, etc., contains a discussion of the filtration problem in Bangor, by Jas. M. Caird, chemist and bacteriologist. The subject of the use of various coagulants is entered into fully and the difficulties of mixing, quality of chemicals and methods of application are briefly recounted.

The annual report of the Massachusetts highway commission is divided into two parts. The first part concerns itself with state highways, their maintenance and improvement, giving especial attention to the treating of roads with tar and oils to offset the wear of automobile tires. The second part is devoted to the supervision of telephone and telegraph companies. Appendices contain statistical data on various individual corporations.

The report of the city engineer of Milwaukee contains a number of photographs of street bridges in that city. These, with accounts of tests of pumping engines at the North Point station, and costs of operation of pumps, are unique features of the report.

The annual report of the city comptroller and treasurer of Minneapolis, Minn., is exceptionaly well prepared, full details being given of all items.

A Creditable City Magazine.

The November issue of *The Live Wire*, of Buffalo, N. Y., is the first of a new type of "booster" magazine for that city. The publication is an example of an up-to-date municipal paper and seems to have been correctly named. Mr. William S. Crandall, the editor, has had a wide experience in municipal editorial work and is well fitted to have charge of the publication.

ORGANIZATIONS AND INDIVIDUALS

Road Builders—Iowa Engineers—Illinois Engineers—Iowa Cement Users—N. A. C. U.—New York Cement Show—National Municipal League—Good Roads—Technical Associations—Technical Schools—Civil Service—Personal Notes

Iowa Engineering Society.

The proceedings of the Iowa Engineering Society for 1910 contain the following papers of interest: "Bitulithic Pavement at Grinnell, Ia.," by W. E. Beard; "Concrete Construction in Cold Weather," by J. H. Chubb; "Rates for Electric Service," by A. H. Ford; "The Direct Method in Illuminating Engineering," by L. B. Spinney. In addition to these papers, the reports of various committees are given in detail.

American Road Builders' Association.

The seventh annual convention of the American Road Builders' Association will be held at the German House, Indianapolis, Ind., on December 6, 7, 8 and 9. In connection therewith will be held a congress of road builders and a "good roads show."

Among the speakers who have already accepted places on the program are the following: "Relation of the City to Its Adjacent Country Highways," A. B. Lea, Director Public Service, Cleveland, Ohio; "Some Features of Road and Bridge Construction, A. N. Johnson, State Highway Engineer of Illinois; "History of Roads in Province of Saskatchewan," F. J. Robinson, Deputy Minister of Public Works, Province of Saskatchewan, Canada; E. J. Watson, Commissioner of Agriculture of South Carolina; "Present Highway Laws of Ohio and the proopsed New Law," James C. Wonders, State Highway Commissioner of Ohio; "The National Grange and Good Roads," N. J. Bachelder, Master of the National Grange; S. Percy Hooker, Chairman New York State Highway Commission; C. D. Miller, Assistant Territorial Engineer of New Mexico; "Application of the Highway Law of Pennsylvania," Jos. W. Hunter, State Highway Commissioner of Pennsylvania; "Progress of Road Building in Michigan," Townsend A. Ely, State Highway Commissioner of Michigan; "State Highway Legislation," Logan Waller Page, Director U. S. Office of Public Roads; Geo. W. Cooley, State Engineer of Minnesota; "A Division of Road Interests for Better Results," Major W. W. Crosby, Chief Engineer, Maryland State Roads Commission; Harold Parker, Chairman Massachusetts State Highway Commission; "Convict Labor," Samuel Hill, President Washington State Good Roads Association; "Earth Roads," Charles P. Light, Commissioner of Roads of West Virginia; "The Best Method of Supervision and Control of Road Construction in a State," Jos. Hyde Pratt, State Geologist of North Carolina; "Road Building in South Dakota," Samuel H. Lea, State Engineer of South Dakota; "Road Building in North Dakota," T. R. Atkinson, State Engineer of North Dakota; Paul D. Sargent, State Highway Commissioner of Maine; Col. Frederick Gilkyson, Commissioner of Public Roads of New Jersey; W. O. Hotchkiss, Chief of Highway Division, Geological Survey of Wisconsin; P. St. J. Wilson, State Highway Commissioner of Virginia; "Bridge and Culvert Construction," W. S. Gearhart, State Highway Engineer of Kansas; James H. MacDonald, State Highway Commissioner of Connecticut.

The membership of the American Road Builders' Assosciation includes the foremost road-making and street-paving authorities of the United States and Canada, men occupying the chief administrative and engineering positions in the highway departments of states, counties, cities and towns. The experience of these men embraces work with all the materials and methods used in the construction of country roads and city streets and the building of highways under all the varying conditions encountered throughout the country. The opportunities afforded by the convention of the association to learn from these men, both through the papers prepared and presented by them and by personal meeting with them, render the annual convention of the American Road Builders' Association one of the chief events of the year in road-building circles.

Following the custom inaugurated last year at the sixth annual convention at Columbus, O., the exhibition of materials and machinery will form an important feature of the convention. Ample exhibition space has been obtained in the German House and the grounds connected with it, thus bringing the meetings and the exhibits together and facilitating attendance upon both without the loss of time. The exhibits will include the various materials and the most improved machinery and appliaances for road making and street paving. The greater number

of exhibits will be shown in the German House, while the larger and heavier machinery will be displayed in the adjacent grounds.

The meetings and exhibits will be open to the public and a general invitation is extended to every one interested in any branch of highway work. The headquarters of the association are at 150 Nassau street, New York City.

Iowa Cement Users.

The seventh convention of the Iowa Association of Cement Users will be held at Cedar Rapids, Ia., January 10 to 13, 1911. The program will include a discussion of the cement tile problem by Prof. A. Marston, of Iowa State College; an illustrated lecture on bridge and culvert work, supplied by the Iowa Highway Commission; a paper on cement street paving, by C. P. Chase, C. E., of Clinton, etc. The convention sessions will be held in the morning of each day and the cement show will be open afternoon and evening.

The Illinois Society of Engineers and Surveyors.

The twenty-fifth annual report of the Illinois Society of Engineers and Surveyors contains an unusually large number of papers concerning municipal problems. Among them were the following: "Municipal Engineering in Cairo, Ill.," W. B. Thistlewood; "Tests of Simple Surveying Instruments," by Prof. J. T. Stewart, of Minnesota State University; "Municipal Ownership of Public Utilities," by J. W. Dappert, Taylorville, Ill.; "Recent Practice in Sewage Purification," by W. D. Gerber, 1200 Hartford building, Chicago; "Sewage Testing Plant of the Sanitary District of Chicago," by Langdon Pearse, Chicago; "Sewage Disposal for Small Institutions" and "Hydraulic Engineering at the University of Illinois," by G. C. Habermeyer, Champaign, Ill.; "Chicago's Sidewalk Practice," by N. E. Murray, 120 Clarke avenue (Austin); "Workmanship vs. Materials in Street Paving," by W. W. Marr, 300 City Hall, Chicago; "Earth, Gravel and Macadam Roads," by M. O. Eldridge, chief of department of highways, U. S. Agricultural Bureau, Washington, D. C.; "Testing of Road Materials" and "Instruction in Road and Pavement Construction at the University of Illinois," by R. B. Slippy, Waterloo, Ia.; "Good Roads in Central Illinois," by J. O'Brien, Champaign, Ill.; "Cost Data for Reinforced Concrete Highway Bridges," by A. N. Johnson, state highway engineer, Springfield, Ill.; "Relation of Typhoid Fever and Water Supplies" and "Surface Water Supplies of Illinois," by E. Bartow, University of Illinois, Champaign, Ill.; "Reinforced Concrete Aqueduct Lining," by H. E. Reeves, Atkinson, Ill.; "Water Supply and Drainage Investigation of the Illinois Co-operation," by R. I. Randolph, 748 First National Bank building, Chicago.

In addition to these papers of immediate interest to the municipal engineer, there were several other papers, and a number of discussions of interest and value to engineers in general. The next meeting of the society will be held in East St. Louis in January, 1911.

National Association of Cement Users.

The seventh convention of the National Association of Cement Users will be held in Madison Square Garden, New York, on December 12 to 16, in connection with the New York Cement Show, which is held December 14 to 20.

The sectional committees will meet at 2 p. m. of Monday, the 12th, and that on roadways, sidewalks and floors will discuss the preparation of materials, laying, finishing and costs. The formal addresses of welcome will be delivered in the evening, followed by a business session and papers on "Dustless Concrete Floors," by L. C. Wason, of Boston, Mass.; "Some New Methods in Sidewalk, Curb and Gutter Construction," by Jerome B. Landfield, Binghamton, N. Y., and the report of the committee on sidewalks, roadways and floors, by C. W. Boynton, chairman.

On Tuesday morning, December 13, there will be a meeting of the section on concrete and reinforced concrete, with a general discussion on selection of materials, methods of construction, costs, etc., followed by the regular session, at which will be presented the report of the committee on reinforced concrete and building laws, by A. E. Lindau, chairman, and papers on "Web Reinforcement of Concrete Beams," by Peter Gillespie, University of Toronto, Canada, and Major John Stephen Sewell, consulting engineer, Gantts Quarry, Alabama; "Flat Slabs of Reinforced Concrete," by Arthur N. Talbot, University of Illinois, Urbana, Ill.; "Discussion of Flat Reinforced Concrete Plates," by Angus B. MacMillan, Boston, Mass.; "Analysis of Results of Load Tests on Panels of Reinforced Concrete Buildings," by Emile G. Perrot, architect, Philadelphia, Pa.

In the evening will be given the annual address by the president, and papers on "A Comparison of the Concrete Industry in Europe and America," by Dr. Otto Schott, director, Offenbach Plant, Heidelberg and Mannheim, Portland Cement Company, Heidelberg, Germany; "The National Fire Protection Association and Its Work," by W. H. Merrill, president, Chicago, Ill., and "Some Thermal Properties of Concrete," by Prof. Charles L. Norton, Massachusetts Institute of Technology, Boston.

This will be followed by a business session, with report of executive board, determination of place of next convention and election of officers.

On Wednesday morning, December 14,

the sections of fire-proofing and insurance will hold a topical discussion on fire resistive construction of buildings and the effect on insurance rates, followed by the report of the committee on fire-proofing, by Rudolph P. Miller, chairman; the report of the committee on insurance, by William H. Ham, chairman, and papers on "An Incident of Value of Concrete in Reducing Cost of Insurance," by Emile G. Perrot, Philadelphia, Pa., and "Effect of Electrolysis on Metal Imbedded in Concrete," by Cloyd M. Chapman, New York, N .Y.

The evening session will have papers on "Construction Problems of the Aziscones Concrete Gravity Dam," by Seth A. Moulton, Portland, Me.; "Preparation and Handling of Concrete," by H. M. Cryder, St. Louis, Mo.; "Advantages and Comparative Cost of Spouting Concrete," by F. E. Engstrum, Los Angeles, Cal.; "The Use of Compressed Air in the Handling of Mortars and Concrete," by G. L. Prentiss, New York.

For Thursday morning, December 15, is set the meeting of the section on specifications for cement products, which will discuss the manufacture, curing, cost, etc., of cement hollow building blocks, architectural concrete blocks, fence posts, drain tile and pipe. This will be followed by the report of the committee on specifications for cement products, by P. S. Hudson, chairman, in two parts, (a) "Proposed Standard Specifications for Architectural Concrete Blocks," (b) "Proposed Standard Specifications for Plain Concrete Drain Tile." Papers will follow on "General Considerations in the Construction of a Cement Products Plant," by Charles D. Watson, Syracuse, N. Y.; "Cement Tile Plant—Layout and Operation," by C. M. Powell, Universal Portland Cement Company, Chicago, Ill., and "Additional Notes on Steam Curing Plants," by F. S. Phipps, St. Joseph, Mo.

The reception and banquet will be held on the afternoon of Thursday.

Friday morning will have the meeting of the section on treatment of concrete surfaces, with a topical discussion on the artistic treatment of concrete surfaces of various kinds, followed by the general session, at which will be presented the report of the committee on exterior treatment of concrete surfaces, by L. C. Wason, chairman; proposed specifications for stucco on metal lath, and papers on "Comparative Cost and Maintenance of Various Types of Building Construction," by J. P. H. Perry, Turner Construction Company, New York, N. Y.; "Concrete Filled Arches," by H. H. Quimby, engineer of bridges, bureau of surveys, Philadelphia, Pa., and "Reinforced Concrete Sewers," by J. A. Hooke, assistant sewer commissioner, St. Louis, Mo.

In the evening there will be papers on "The Hudson Memorial Bridge," by William H. Burr, professor of civil engineering, Columbia University, New York, N. Y.; "Reinforced Concrete Construction in San Francisco and Vicinity," by John H. Leonard, San Francisco, Cal.; "Reinforced Concrete School Buildings," by John T. Simpson, Newark, N. J.; "The Use of Reinforced Concrete for Hospitals and Similar Structures," by R. A. McCullough, New York, N. Y., and "Advantages of Reinforced Concrete for Farm Buildings," by Alfred Hopkins, architect, New York, N. Y.

As noted elsewhere, the eastern railroad organizations grant a round trip rate of one and one-half fares, which those from points outside these districts, roughly west and south of New York and Pennsylvania, can avail themselves of by purchasing these tickets at the first station within the district.

The New York Cement Show.

The first annual New York Cement Show will be held in Madison Square Garden, New York City, on December 14-20. Advance notices indicate that it will eclipse all previous efforts along this line. Cement, aggregates, reinforcing systems, water-proofing methods, concrete mixers, concrete tile, block machines, coloring compounds, forms, ornamental concrete work and a complete representation of every article and appliance entering into the use of cement will be displayed. The show will be orderly and artistic in the best sense. Every possible effort will be made to make the exhibition as attractive as it is possible to make a show of this character. Two hundred and fifty exhibitors will have displays of vital interest to the trade.

The publicity committee of the Association of American Portland Cement Manufacturers are arranging for a most interesting series of addresses, to be delivered in the concert hall of Madison Square Garden during the New York Cement Show. A number of very prominent speakers have already consented to appear, and Mr. Albert Moyer is conducting negotiations with a number of other men of national reputation.

Thus far addresses have been secured from the following men upon the subjects mentioned: Rudolph P. Miller, building commissioner of New York City, on "Fire-proof Materials;" Calvin Tomkins, commissioner of docks and terminals, on "Transportation Terminals;" Logan W. Page, director of the Office of Public Roads, United States Department of Agriculture, on "Rural Highways;" C. P. Goodrich, consulting engineer of the city of New York, on "Important Reinforced Concrete Structures."

This series of talks will be made afternoons and evenings during the show. A large number of interested people will receive special invitations to attend, although the meetings will be open to any who want to hear the lectures.

On account of the annual convention of the National Association of Cement Users, which will be held in New York during the cement show, December 14-20, the railroads in the Trunk Line Association, the New England Passenger Association and the Eastern Canadian Passenger Association have made a reduced rate of a fare and one-half from all points from which going tickets are 75 cents or more.

The Annual Convention of National Municipal League.

The sixteenth annual convention of the National Municipal League was held at Buffalo, N. Y., November 14 to 17. This organization is devoted to municipal reform in its broader constructive aspects, as related to measures rather than particular men. It now has a membership of more than 2,000, having made notable increases during the past few years. For some seven years past it has been under the presidency of the Hon. Charles J. Bonaparte, a member of the cabinet of ex-President Roosevelt. At the convention just closed Mr. Bonaparte was succeeded by the Hon. William Dudley Foulke, of Richmond, Ind., formerly United States Civil Service Commissioner. The secretary of the league, Mr. Clinton Rogers Woodruff, of Philadelphia, was continued in office.

Among the subjects discussed during the convention were the municipal franchise question, city budgets, finances and statistics, and the commission form of government. A variety of other phases of municipal government and administration were brought before the convention by means of formal papers, committee reports and informal discussion at the "round table" luncheons held each day.

Good Roads Association.

The national convention of the Good Roads Association, which met at Oklahoma City, Okla., October 4, 5 and 6, adopted the following resolutions:

Resolved, By the delegates to the eleventh National Good Roads Convention, from Alabama, Idaho, Illinois, Kansas, Minnesota, Missouri, New York, Ohio and Texas, in convention assembled at Oklahoma City, October 4, 5 and 6:

That the cost of permanent highway construction and maintenance should be paid jointly by the county, state and nation, and that the national government should make a reasonable appropriation for such purpose, and we urge upon every voter to oppose any candidate for the state legislature or the national congress who will not pledge himself to work for such national aid for post roads.

We believe that the vast annual expense for war preparations is excessive. Why not use half of this fund for good roads? We also believe that from experience convict labor, where justly used, is a great benefit to the construction of public roads, and advocate such under the system now prevailing in Colorado.

Several interesting papers were read advancing ideas in regard to road building and proper road construction. The principal address delivered was by B. F. Yoakum, chairman St. Louis & San Francisco Railroad Company, on the second day, October 5.

Technical Associations.

The 1910 volume of proceedings of the Indiana Engineering Society is unique in the field of society publications. Almost all of the papers given are profusely illustrated by photographs or drawings, adding materially to the interest and value of the subjects presented. Prof. Howe's historical paper on arch bridges is especially well illustrated, about thirty different photographs of bridges of note being reproduced.

The annual publication of the Connecticut Society of Civil Engineers contains the following articles of interest to those engaged in municipal work: "Eight Weeks' Civic Study Abroad," by F. Luther Ford, city engineer of Hartford, Conn.; "Dams Approved by Mr. Henry T. Potter," by Chas. E. Chandler, city engineer of Norwich, Conn.; "The Sea Wall in Connection with Power Stations and Manufacturing Buildings," by Geo. A. Orrok, 55 Duane street, New York City.

The thirteenth annual convention of the League of California Municipalities was held in San Diego, Cal., on November 16, 17, 18 and 19.

A paper on "Engineering Work by the Bureau of Sewers in Brooklyn Borough" was presented by Mr. James B. Van Vleck, at a regular meeting of the Brooklyn Engineers' Club, on November 10.

A paper entitled, "Some Problems in Sewage Disposal of New York," was presented by Col. W. M. Black, Corps of Engineers, U. S. A., at a meeting of the Municipal Engineers of the City of New York, held November 23.

The eleventh annual meeting of the National Civic Federation will be held January 12, 13 and 14, 1911, in New York City. The important topics of the hour, in which the Federation has been especially interested and which will be considered, are: Regulation of corporations and combinations; regulation of railroads and municipal utilities; compensation for industrial accidents; arbitration and conciliation.

A "city planning conference" was held on November 14, 15 and 16, in Los Angeles, Cal. Papers were read on various phases of the city planning question.

The next annual meeting of the Indiana Engineering Society will be held January 12, 13 and 14, at Indianapolis, at the Denison Hotel. A feature of same will be the annual exhibit for manufacturers of anything of interest relating to the engineering profession. Space for ex-

hibit can be secured on application to the secretary, Union Trust building, Indianapolis, Ind.

The annual meeting of the Canadian Society of Civil Engineers will be held at Winnipeg, Man., on January 2-6. Secretary C. H. McLeod, 413 West Dorchester street, Montreal, Que.

At the meeting of the Engineers' Club, of St. Louis, on November 11, Mr. Mont Schuyler, engineer in charge of the city testing laboratory of St. Louis, presented a paper entitled "Certain Theoretical Aspects of Specifications."

The Technical Schools.

The students of the School of Engineering of the Pennsylvania State College are at work installing a wireless telegraph station in the buildings devoted to electrical engineering. With this apparatus they will communicate with stations at Washington, New York, Philadelphia, Boston and elsewhere. The same institution has erected buildings and installed a great calorimeter, 12x12x12 feet, to be used in testing the heat conducting characteristics of various forms of building construction and materials. In connection with this calorimeter are an ice plant and a heating plant for the purpose of properly regulating the temperatures. Tests of the kind specified should be of great service for determining the proper form of building construction, and for accurately designing heating and ventilating plants.

Bulletin No. 379, of the extension division of the University of Wisconsin deals with the commission plan of city government. Bulletin No. 388 is a preliminary announcement of the Institute of Municipal and Social Service in Milwaukee.

"The Effect of Keyways on the Strength of Shafts," by Herbert F. Moore, has just been issued as bulletin No. 42 of the Engineering Experiment Station of the University of Illinois. This bulletin gives the results of tests to determine the relative strength of solid shafts and of shafts with keyways. A table showing power transmission by cold-rolled shafting with keyways and a diagram illustrating the weakening effect of keyways are given.

On November 12 occurred the dedication of several new buildings for the department of practical mechanics of Purdue University, at Lafayette, Ind. These buildings accommodate the department of practical mechanics and provide facilities for instruction in mechanical drawing, descriptive geometry and shop work. The main building contains 25,000 square feet of floor space, can accommodate at one time 400 students in drawing, and has locker accommodations for 1,200 students. The lecture room seats 300 and there are two class rooms, each having a capacity of sixty students. The shops cover 43,000 square feet of ground and are capable of accommodating a group of 350 students at one time. The machines, tools, benches, lockers—in fact, all the details of the equipment are modern, while many of the special features are unique. The buildings, as a whole, constitute what is probably the largest and most completely equipped plant for the instruction of students in shop practice and drawing in this country and represent the accumulated experience of twenty-five years at this university.

Civil Service Examinations.

The United States Civil Service Commission announces examinations at the usual places, as follows:

Dec. 7: Fortification draftsmen, at a salary of $1,500 per annum, and cartographic draftsman at $3.84 per diem.

Dec. 7: Superintendent of construction, U. S. Penitentiary, McNeil Island, Wash., at a salary of $5 per diem.

Personal Notes.

John A. Dent, recently with the oil pipe line service of the New York Transit Company, has been appointed instructor in mechanical engineering at the University of Illinois.

H. B. Dirks, instructor in mechanical engineering at the University of Illinois, has resigned to accept a position as assistant to the general manager of the National Machinery Company, Chicago, Ill.

Dr. Allerton S. Cushman, assistant director of the Office of Public Roads, U. S. Department of Agriculture, has resigned, and will establish a laboratory in Washington, D. C., for the purpose of engaging in original research.

Mr. Walter Brinton, formerly superintendent of the manganese steel department of the Taylor Iron and Steel Company, at High Bridge, N. J., has become consulting engineer for the Edgar Allen American Manganese Steel Company, at New Castle, Del.

Mr. George E. P. Smith, Assoc. M. Am. Soc. C. E., irrigation engineer at the Agricultural Experiment Station at the University of Arizona, is taking a year's leave of absence to make investigations in irrigation and hydraulic engineering at the University of Wisconsin.

E. Stutz has retired as vice president and general manager of the Goldschmidt Thermit Company. The affairs of the company will henceforth be conducted by Mr. William C. Cuntz, as general manager and treasurer. Dr. F. H. Hirschland has been elected vice president.

Mr. John A. Bensel, president of the American Society of Civil Engineers, has been elected state engineer of New York on the Democratic ticket, succeeding Mr. Frank M. Williams, Republican. Mr. Bensel is at present president of the board of water supply of the city of New York.

Mr. D. W. Dedrick will have charge of the newly established work in milling engineering in Pennsylvania State College. Mr. Dedrick has designed, built and operated some of the largest flour milling plants in the country. He has contributed much valuable matter to the technical press, and he is ex-president of the National Association of Millers. The

preparation of technically trained men for the milling industries is a new educational development, but is one which bids fair to be of great service to the country.

Prof. Joseph Baker Davis, who has been a member of the faculty of the engineering department of the University of Michigan since 1872, resigned recently. In recognition of his services to the university the board of regents, upon accepting his resignation, made him professor emeritus.

Alfred Noble is the first civil engineer to receive the John Fritz medal, the highest honor at the disposal of American engineers. The medal was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on August 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress. It is awarded by a board of sixteen, made up in equal numbers of members of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. It is awarded for notable scientific or industrial achievement and there is no restriction on account of nationality or sex.

MACHINERY AND TRADE

The G-K Sewer Pipe Inspector.

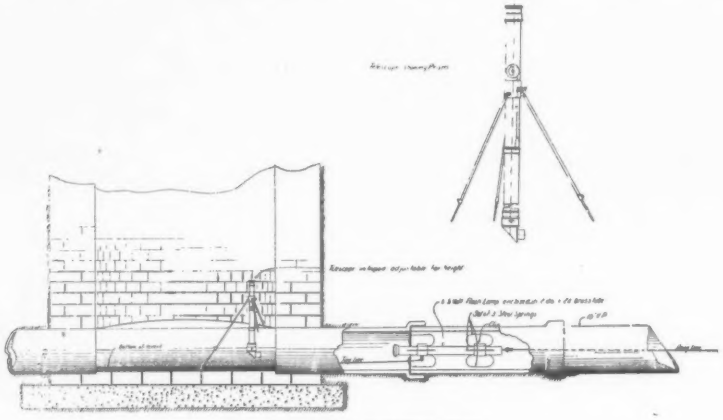
The difficulty of making the needed inspections of small sewers is appreciated by every one whose duty has led them to assume a cramped and tiring position over a manhole, watching in a mirror held at the opening of a sewer, to catch the reflection of the sunlight in another mirror held at a manhole some distance away. Under the best of conditions this method of inspection is applicable to a very limited length of sewer, and practically the only satisfaction obtained is to locate an obstruction approximately.

Mr. W. W. Dixon, engineer of the Union Clay Products Company, 50 Church street, New York, has applied for a patent on an appliance which he used with great success in the city of Summit, N. J. This apparatus consists of a traveling light and a telescope for observation.

The light consists of an electric hand torch, either carrying dry batteries or else furnished with a long wire connecting it to a storage battery. The light is protected by two sets of springs, three springs to a set, so arranged as to hold the light away from the side of the sewer as it is being drawn through it.

The method of operation is very simple. The light is dragged through the sewer, and attached to it is a steel tape, which is paid out from the point of entrance, so that when an obstruction, break or leak is discovered and illuminated, reference to the tape will locate it exactly. The front of the bulb of the lamp is silvered, so as to overcome the glare from the light.

To avoid discomfort to the observer, Mr. Dixon has devised a telescope, so arranged as to make it unnecessary to as-



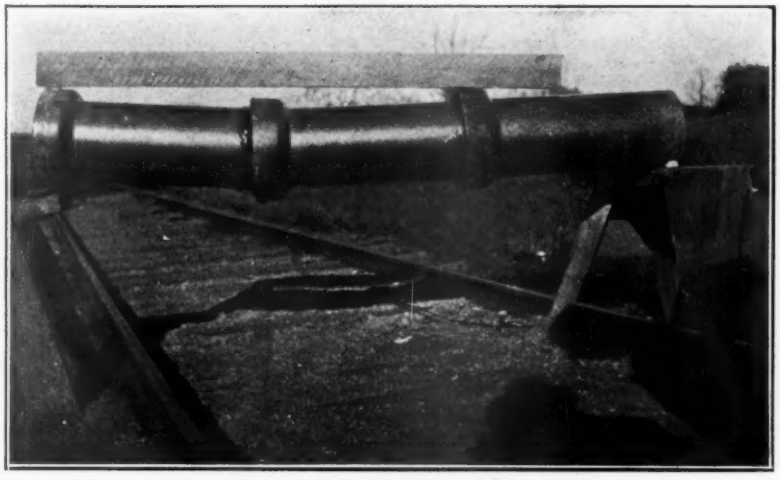
G. K. SEWER INSPECTOR.

sume a cramped position. The telescope, with a power of about fifteen diameters, is equipped at the object end with a right-angled prism, so set as to reflect all rays coming at right angles to the axis of the telescope. The telescope is mounted on a tripod with adjustable legs, so that it may be set up regardless of irregularities in the bottom of the manhole. A rack and pinion adjustment is provided for adjusting the telescope so as to receive the rays from the lamp directly along the axis of the sewer.

Mr. Dixon has used the apparatus to detect flaws, leaks, breaks, obstructions, etc., in sewers, as well as in making inspections of new pipe lines previous to their acceptance by the city.

A Successful Water-Tight Sewer Joint.

A sewer joint packing allowing of greater flexibility between the pipe sections has recently been placed on the market. It permits a marked settlement of a pipe joint without any resultant leakage. This material consists of linseed oil vulcanized with sulphur, mixed with clay. When used the material is heated to about 300 degrees and poured as would be a lead joint in water pipe. In pouring it a short length of rubber hose may be used instead of the asbestos runner ordinarily used for water mains, the hose being rubbed with a greasy material, as it is found that the joint material does not adhere to grease, but does adhere to asbestos or to clay or other moist substances. In fact, one of the peculiarities of this substance is the fact that it adheres to wet pipe, probably removing the moisture in the form of vapor produced by the heat of the mixture. The material is known as G-K sewer joint compound, and is manufactured by the Union Clay Products Company, of 50 Church street, New York.



TEST OF G. K. WATER TIGHT SEWER JOINT.

The results obtained by the use of the material are mentioned in a report of Mr. W. C. Van Duyne, chief engineer of the East Orange and Ampere Land Company. An abstract of this report is given as follows:

The system we are building at present comprises about 15,000 feet of 8 and 10-inch sanitary sewers. In making the calculations we allowed for an infiltration of 33 per cent. Sulphur joints were used exclusively, and we took all precautions possible, even to coating the finished joints with cement.

The property here is that formerly owned by the Orange Water Company, and is that from which East Orange used to pump their entire water supply. Naturally the ground is very water soaked, the water table rising to within 2 feet of the surface in many points. Our storm sewers are as yet not completed to the point where they will reduce the water table to any appreciable amount.

About a month ago I saw that I was going to have an infiltration of over 33 per cent. on the whole system. Some of our sewers were placed within 6 inches of quicksand. Within the last two weeks we have laid two stretches of 8-inch pipe, using G-K compound in the joints, one in a 12-foot trench and the other in a 2-foot trench. The pipe line in the 2-foot trench has been standing for a week and a half now, with about 1 foot of water over the top of the trench. The late rains converted that section into a pond, and I have not had the water drawn off, since I wished to see what effect it would have on the sewer. As yet I have detected no infiltration. The section in the 12-foot trench is giving equally as good results.

We are taking care to have the G-K compound very hot, probably 500 to 600 deg. F., before pouring it, as was suggested. We find that the joints are made more readily, and that any moisture which may be in the pipe is driven out and a perfect bond made. The joints are made with much more ease than the sulphur joints were made.

Some interesting tests of the joints were made recently by the city of Summit, N. J., under the direction of Mr. L. A. Oaks, superintendent of streets and sewers. Two 3-foot lengths, deep and wide socket, 8-inch pipe, were laid level and caulked with two strands of yarn, joint runner placed, the compound then heated and poured in the usual manner. After cooling, the ends were plugged with rubber sewer plugs, with ½-inch pipe connection to city water on one end and steam gauge on the other. The water was turned on, and the gauge showed 22 pounds, at which pressure one of the end plugs came out. In about five minutes after replacing plug the pressure was held at 20 pounds for some time and no leak could be found, or sign of weakness. This pipe was then placed on the floor, with 4-inch blocks under each end of the pipe, and left until the next day with some extra weight on the center or bell. By this time the pipe had deflected about 2 inches. The water was left in the pipe for several days and no leaks appeared. Some weeks afterward this pipe was reversed and became straight, and is still fast and firm in the joints.

The result of a similar test may be noted from the accompanying photograph. In this case even under the extreme condition of two unsupported joints, no leaks could be detected in either.

Sprinkling in Rio Janeiro.

The city of Rio de Janeiro, the capital of Brazil, South America, is without doubt one of the most beautiful as well as finest organized cities of its size in the world. A few years ago this was not so. At that time the streets were for the most part narrow and unwholesome, the sanitation was of the worst and the transportation facilities were no better. Now it is a city of broad streets, up-to-date city transportation and fine buildings, with sanitary and lighting equipment of the best. This was all made possible through the broad-minded policies of the municipal authorities, who, when the reconstruction of the city was commenced, decided that all equipment was to be for the best and most practical use. The accompanying illustration shows part of an equipment of twenty-five Studebaker sprinkling wagons and harness which was furnished the city shortly after its reconstruction.

STUDEBAKER SPRINKLERS IN HANANA.

Capacity of Portable Asphalt Plant.

In the November issue of MUNICIPAL ENGINEERING a reference was made to the portable asphalt plant manufactured by the Link-Belt Company, of Chicago. In this article mention was made of the capacity of the plant, and in that connection a typographical error was overlooked by the proof-reader, giving an entirely wrong idea of the value of the machine. The paragraph in error should read as follows (page 410):

"The average capacity of the plant under normal conditions is conservatively rated at 800 square yards of 2-inch thick pavement per day of nine hours," etc.

Inasmuch as reports are frequently re-

ceived from users of this machine rating it as high as 1,300 to 1,400 square yards of 2-inch to 2½-inch pavement per day, it will be seen that 800 square yards per day is a very conservative rating.

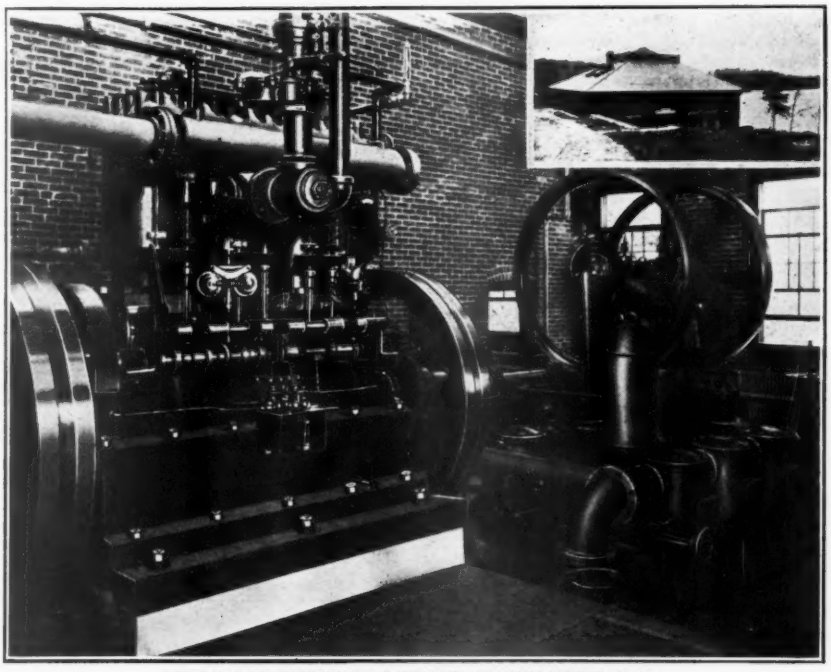
The Gas Engine in Municipal Pumping Plants.

During the past few years several municipal pumping installations have been made in which the required power is derived from gas engines operating on fuel supplied by suction gas producers. In units up to 3,000,000 gallons daily capacity, or within sizes allowed by the triplex power pump makers, such installations have shown a degree of efficiency secured only by steam units of very large sizes.

By the use of a triplex power pump showing an efficiency of 75 per cent. or over, a producer which will deliver to the engine 75 per cent. of the B. t. u. contained in the coal, and an efficient engine, a duty of approximately 150,000,000 foot pounds per 100 pounds of fuel is attained. This result is possible with units of a capacity as small as 350 gallons per minute. With the larger sizes slightly better economy is secured. Such a plant requires a minimum of attendance. The producer is charged once every ten hours, and if of the anthracite type, little care is necessary between periods of charging.

The installation shown is one of the units of the Manchester, Mass., plant, which consists of four 1,000,000-gallon units. The results secured have been highly satisfactory to the town. The installation was made by the National Meter Company, of New York, builders of the Nash engine. Triplex pumps are of the Gould's make, and the producers were furnished by the Smith Gas Power Company, Lexington, O.

The pumps are connected with the engines by means of friction clutches, which, with a by-pass gate on each pump, allow the greatest degree of flexibility in operation. The mechanical efficiency of the pumps is guaranteed to be from 80 to 85 per cent.



THE NASH PUMPING ENGINE, USING FUEL GAS.

The routine work of starting and operating the plant is as follows:

First, the fire in the producers is cleaned; ashes are removed from the lower doors and the producer is charged with coal for the day's run. The producer is then closed, the ventilating pipe which runs through the roof is opened, and the fire blown up by an artificial draft.

Inasmuch as the gas is drawn to the engine from the producers by the suction of the engine pistons, it follows that in order to obtain a uniform flow of gas the engine must be in motion. This is provided by compressed air from tanks at a pressure of from 150 to 175 pounds per square inch. As soon as the cylinders are charged the explosions take place regularly, and the cylinder into which com-

pressed air has been admitted has its supply of air cut off and its connection with the gas line re-established, and it, in turn, receives explosions with the other two.

With the engine in operation, the proper combination of gas and air to provide an explosive mixture is obtained by the proper manipulation of the valves upon the engine. These require considerable care and judgment in operation, especially when the fire in the producer is new or the atmosphere extremely humid. Experience renders the operators extremely skillful.

The mixture is exploded in the cylinders in starting by a current from storage batteries, and as soon as the engine is running smoothly the storage batteries are cut off, and the current is furnished by a magneto belt driven from the engine. This magneto is connected with the storage batteries in such a way that the excess of current furnished by it over that required by the engine for ignition is "floated" upon the storage batteries. The guarantees of fuel economy from the three contractors for machinery were such that at full load and on a ten-hour run, with the plant lying idle or "standing over" for fourteen hours, a brake horse power could be generated at an expenditure of one pound of coal, of a heat value of at least 1,250 B. t. u. The plant has a sufficient reserve power to save in the depreciation due to wear and tear.

The American Service Company.

The management of the Pittsburg Engineering Agency have formed a business company to take over the foreign and territorial business and representation service of the Associated Bureau System, comprising the Bureaus of Technical References, American Trade Catalogs, Engineering and Industrial Research, to be operated under capable technical management and under the name of the American Service Company, with offices in the Bessemer building and associated agencies at all industrial centers. The first named bureaus are at the convenience of the engineering profession and industrial operators gratis. Correspondence with the chairman of the executive committee is always invited.

The Application of Oil to Highways.

The general popularity of the oiling treatment as a means of laying dust and preventing raveling has led to an increased effort to obtain a satisfactory method of applying the oil. The practical machine for this purpose must be able to distribute readily the various tar and asphaltic products which are on the market. Not only must it so control the flow that little or much can be spread upon the road, and so prevent waste of material, but the distribution must be even, to save the cost of hand brooming. With many machines it is a case of feast in one place and famine in the other. Puddles of oil on the roads not only bespatter and smear up vehicles and the clothing of their occupants, as well as pedestrians, but are also injurious to the road.

The Topping oiler, manufactured by Howell Topping, 50 Church street, New York City, seems to have overcome most of the difficulties encountered in the application of oil. This oiler may be attached to the ordinary sprinkling cart. It coats the road surface uniformly, with no puddles nor dry streaks, and it may be used with utility and value with either the light or the heavy oils of either tar or asphaltic base.

A full description of oiler and its use will be mailed upon application to Howell Topping.

Extensive Paving Contracts in Jackson, Miss.

On October 4 the city of Jackson, Miss., received proposals for the paving of 25,800 square yards of State street, one of the leading residential streets.

The prices for excavation ranged from 35 to 50 cents per cubic yard, and for foundation and surface, including five-year guaranty, the lowest bids for the several classes of pavement were as follows:

Asphalt, per square yard	$1.75
Bitulithic, per square yard	2.15
Creosoted wood block, per square yard	2.14

After careful consideration the council awarded contracts for bitulithic to the Southern Bitulithic Company.

Some dissatisfaction and talks of injunction were engendered by the unsuccessful contractors, but at a largely attended meeting of the taxpayers, held October 13, after full discussion, it was unanimously voted to approve the action of the mayor and council in awarding the contracts.

Correction of Erroneous Address.

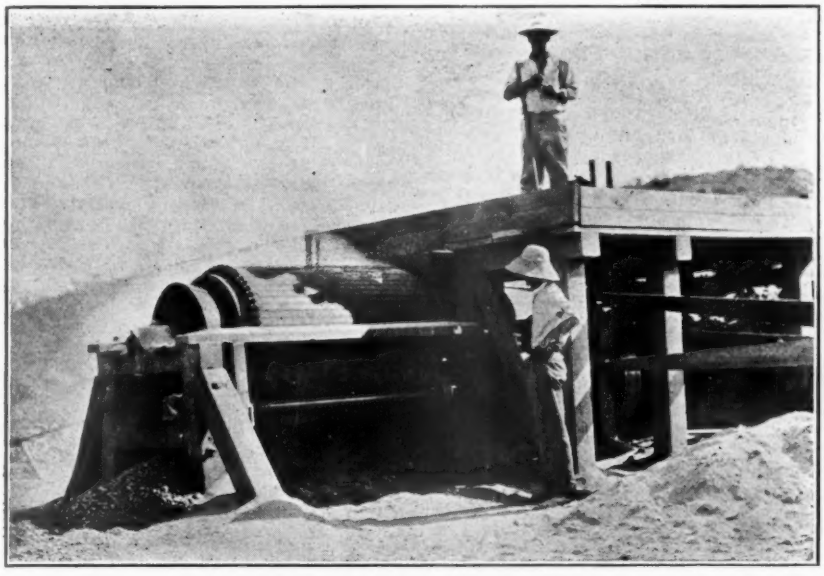
Under an article entitled "The Gravity Carrier in Paving Work," on page 414 of the November number, reference was made to the Mathews Gravity Carrier Company, of Minneapolis. The address of the company mentioned is Merriam Park, St. Paul, Minn.

A Simple, Portable Crusher.

A rock crusher, simple in construction and operation, and easily transportable on the ordinary type of wagon, has recently been patented. The crusher was invented by Mitts Quenner, of Douglas, Ariz., for use in the Altas district of Sonora, Mexico. The character of the rock formations and the difficulty of transportation in this region made necessary a machine which should not only possess the great-

est strength, but should also be easily transferred as required.

The machine designed by Mr. Quenner is now being manufactured and used extensively in a number of lines of crusher work. An accompanying photograph shows the crusher in use in Mexico. As will be noted, no special foundation is required, and no preparation is needed other than setting the machine and connecting it to the driving power. A 20-h.p. gasoline engine will provide sufficient power to crush from twenty to thirty tons of hard material per hour to one-eighth mesh. This output has been attained daily in actual work, and the machine has not yet been run to its full capacity. It is said to do the work of a hundred-stamp mill at about one-tenth the cost of installation.



THE QUENNER ROCK CRUSHER.

The use of the machine in concrete work, where a stone aggregate is used, is particularly to be recommended. It produces a sharp rock at the rate of thirty tons per hour and with a minimum quantity of fines. Its capacity and portability make it of great value in most classes of large concrete work. These two valuable features will also be appreciated by the road builder engaged in the construction of macadam roadways. By simple adjustments of the machine the rock may be crushed in sizes grading from 3 inches to ¼ inch. Its low cost of operation should recommend it for this class of work. Its superior capacity at a low cost per ton of material handled, together with the low first cost, should be carefully investigated by any one considering the purchase of a crusher. Full information and costs will be supplied upon application to the Quenner Dry Crusher Company, Singer building, New York City.

Trade Publications.

The Steel City Electric Company, of Pittsburg, Pa., have issued a special illustrated bulletin describing the Fullman adjustable water-tight floor outlets.

The Barron & Cole Company, Barron building New York City, have an illustrated catalog describing the rock-crushing machinery manufactured by the Eureka Stone and Ore Crusher Company, of Cedar Rapids, Ia. The same company has booklets describing and illustrating the Nims concrete machinery, the Maney four-wheel scraper and Doud's "Acme" center dump and controllable discharge buckets.

Catalog No. 3, of the Union Iron Works, of Hoboken, N. J., contains prices, descriptions and illustrations of the various types of contractors' supplies manufactured by the company. These include about 150 different articles ranging from wheelbarrows to pile drivers.

The Engineering Agency, of Chicago, has a new catalog for distribution describing engineering and drafting supplies.

An illustrated booklet giving views of the factory of the Crown, Empire, Nash and Gem water meters is issued by the National Meter Company, of 84 Chambers street, New York City. The same company has a "Blue Book" entitled "High Quality versus Low Price." The

latter also concerns the types of meters above mentioned.

The Chicago Portland Cement Company, of Chicago, is distributing a "Concrete Weather Bulletin," warning contractors against the approaching cold weather. A copy of this bulletin is attached in the form of a tag to every other sack of cement sent from their plant.

The Elmer P. Morris Company, 90 West street, New York City, the "Outdoor Lighting Specialty House," have recently issued an artistic catalog, No. 19, covering street lighting brackets, in which many attractive designs are illustrated.

The National Meter Company, 84 Chambers street, New York, has just issued a handsome new catalog showing their Nash gas and gasoline engines. The catalog shows the latest designs and improvements in the construction of their engines, and the information it gives will be found valuable to all power users, and the chapters on producer gas and its economy as a fuel should be understood by all. The National Meter Company will gladly advise any one interested in this phase of power requirement.

The fourth edition of Kahn System Standards, just issued, contains a number of additions and revisions so as to include the best and most modern ideas on reinforced concrete designing and estimating, water-proofing, etc. The subject of water-proofing has been completely rewritten and entire new sets of tables for hooped columns and footing added. This publication also contains data on the various Kahn system products for reinforced concrete, steel lath, fire-proofing, steel windows, etc.

The Standard Pavement of the World is the title of a handsomely illustrated book descriptive of pavements made from Trinidad lake asphalt.

The Economy Drawing Table Company, of Toledo, O., has an illustrated catalog of many different types of drawing tables.

"Acme" (Nestable) corrugated metal culverts are briefly described in a series of leaflets from the Canton Culvert Company, of Canton, O.

A reprint of the decision of the case concerning the patent right on the Dunham steam radiator trap is being distributed by the National Vacuum Heating Company, of Marshalltown, Ia.

Bulletin No. 4025, of the Allis-Chalmers Company, Milwaukee, Wis., briefly describes a new motor-driven air compressor, with a few of its applications to various lines of work.

A report concerning the use of "Pioneer" reservoir water-proofing asphalt, in Pensacola, Fla., is given in a folder issued by the American Asphaltum and Rubber Company, of Chicago.

The November number of the bulletin issued by the Universal Portland Cement Company has an especially valuable article by Mr. J. H. Chubb, assistant inspecting engineer of that company. This article deals with the handling of concrete during cold weather. It endeavors to show how entirely useless it is to abandon all work, force men and superintendents to idleness and lose the interest on capital invested, where a measure of caution and the proper handling of materials, together with only a small increased outlay for extras, will make it possible to carry on work throughout most of the winter season. Other items of interest and value are to be found in the bulletin.

The Koehring Machine Company, of Milwaukee, have issued a thirty-page booklet, called "The Mixer," which contains a number of photographs of the interior of the plant where Koehring concrete mixers are made. The greater portion of the booklet is given up to saws, sayings and witticisms commonly attributed to "a good mixer."

The above title is given to an exceptional book published for the Stone & Webster Engineering Corporation, of Boston, Mass. The book is well bound, and the illustrations showing different steam power stations are exceleint in every particular. A half-tone of each of the stations described is given on the right-hand page, while a description and plan view are given on the left.

Trade Notes.

MACHINERY AND SUPPLIES.

The Bush patent centrifugal pumps, until recently manufactured by Jesse Craft, of New York, N. Y., are now in new hands, and are being manufactured solely by the Greaves Specialty Company, 606 Tribune building, New York, N. Y.

PURCHASE OF MACHINERY.

Seattle, Wash.—Bids are requested Dec. 13 for the sale of the following: One Holly pump, capacity 5,000,000 gals.; two Worthington pumps, 2,000,000 gals capacity each; two Worthington pumps, 1,000,000 gals. each; one Dow pump, capacity 2,000,000 gals.; one Dow pump, 1,250,000 gals.; one Dow pump, 500,000 gals.; six 16-ft. tubular boilers, capacity 95-h.p. each; one 16-ft. boiler, capacity 75-h.p. C. B. Bagley, sec. bd. of pub wks., city hall.

Atrovelle, Ark.—Bids are requested on chemical fire engine. C. S. Peck, cy. clk.

MISCELLANEOUS.

Mr. Nicholas S. Hill, Jr., maintains a chemical, physical and biological laboratory in connection with his engineering office at 100 William street, New York City. He is prepared to make bacteriological and microscopical examinations of water and sewage, chemical analyses of water, sewage, sand, coal, oil, cement and alloys, calorific determinations of the heating value of coals, physical tests of sand and cement, special investigations and studies, and pumping engine and boiler tests.

Prof. A. H. Blanchard, of Brown University, Providence, R. I., will establish a consulting practice in highway engineering. Special attention will be given to

consultations, examinations, reports, designs, estimates and specifications relative to roads and pavements, systems of maintenance, highway bridges and the use of bituminous materials in the preservation of roads and the prevention of dust.

Kimball Brothers are located at Broadway, Flushing, New York. Mr. Kimball, the manager, has been associated with Mr. G. A. Roullier as field manager. The new firm is prepared to handle all kinds of surveys.

The contract for installing flashlight police system in Racine, Wis., was awarded to the Dean Electric Company, of Elyria, O., for $5,000.

The contract for furnishing pumps and machinery for the water works of Burlington, Ia., was awarded to the Erie City Iron Works, at $14,500.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Cullman, Ala.—It is reported that several miles of cement walks will be constructed.

Montgomery, Ala.—The paving with bitulithic of Madison ave. from Brainbridge st. to the city is contemplated.

Phoenix, Ariz.—Several miles of new road are to be constructed and extensive repairs will be made.

Helena, Ark.—The paving of Elm st., from Cherry to the Y. & M. C. tracks, will be begun as soon as brick can be secured.

Huntington Beach, Cal.—It is reported that the paving of Alabama, Arcadia and Magnolia aves. is contemplated.

Porterville, Cal.—The paving of Mill and Main sts., to Second, is contemplated.

San Francisco, Cal.—An ordinance providing for repaving of Mission st. with asphalt, cost about $56,000.

San Pedro, Cal.—A survey has been completed for a boulevard from the west basin to the outer harbor, and bids will soon be asked.

Fernandina, Fla.—The city has decided to pave Center st. from 5th to 11th sts., with vitrified brick.

La Grange, Ga.—Voted to issue $250,000 bonds for road improvements in Trop county.

Freeport, Ill.—City Engineer J. A. R. Daniels has prepared plans for 3 miles of brick and macadam pavement. Bids will be asked in January.

McHenry, Ill.—It has been decided to macadamize a number of streets of the town.

Chicago, Ill.—The paving of Cottage Grove ave., between E. 51st and E. 59th sts., is contemplated.

Chicago, Ill.—The board of local improvements has ordered Wabash ave. paved with creosote blocks, between Washington and Congress sts.

Chicago, Ill.—The paving of 5th ave., between S. Water and Van Buren sts., and of Wabash ave., between Washington and Congress sts., is being considered by the board of local improvements.

Springfield, Ill.—Paving and street improvements, to the extent of $100,000, are being considered by the board of local improvments.

Elkhart, Ind.—Paving is contemplated for 19 blocks in Oakland and California aves. A. M. Smith, cy. engr.

LaPorte, Ind.—Bids will soon be asked for the paving of Washington and State sts with brick.

LaPorte, Ind.—The board of county commissioners contemplates the construction of three miles of the Van Wilkinson gravel road. Clyde Martin, co. engr.

Cedar Rapids, Ia.—Paving amounting to $50,000 is contemplated.

Des Moines, Ia.—The city council has decided to make the following improvements: Paving West 35th st., from Grand ave. to Woodland; for extending the sewer on W. 33d st.

Waterloo, Ia.—The city council has passed a resolution providing for the paving of E. and W. 4th sts.

Coffeyville, Kas.—The Montgomery County Good Roads Association will build a 20-mile oiled dirt road to Independence.

Lexington, Ky.—Concrete sidewalks, curbs and gutters for Broadway and E. 3rd st. is contemplated.

Crawley La.—The city has decided to construct 33,000 sq. ft. concrete crossings. J. D. White, cy. engr.

Baltimore, Md.—Bonds in the sum of $1,000,000 have been voted for highway construction.

Grand Rapids, Mich.—Kent county supervisors have appropriated $45,000 to be available for construction of good roads next year.

Crookston, Minn.—Council rejected all bids for paving and directed the city engineer to prepare plans for paving 3rd st. with asphalt.

Lake City, Minn.—The construction of cement or concrete sidewalks is contemplated.

Owatonna, Minn.—Will vote Nov. 8 on the issue of $30,000 paving and sewer bonds.

Winona, Minn.—About $20,000 will be expended for brick paving. Paul Jasmer, cy. recdr.

Belzona, Miss.—Plans for about three miles of concrete sidewalks are being prepared and bids will soon be requested.

Springfield, Mo. — Resolutions have been passed for paving Lombard and Belmont aves. and N. Grant st.

St. Joseph, Mo.—The resurfacing of 8th and Mossins sts. with asphalt is contemplated; $15,000. Alfred Meier, pres. B. of P. W.

Seneca Falls, N. Y.—The citizens on Oct. 25 voted to issue $75,000 bonds for street improvements.

Akron, O.—Ordinances have been passed for paving High st. and Rhodes ave.

Cincinnati, O.—Ordinances have been passed providing for paving and surbing Whiteman st.; constructing concrete supporting walls and reinforced concrete steps in Baymiller and N. Elm sts.; macadaming, curbing and gutters in Probasco ave. John Galvin, pres. council.

Galion, O.—It is stated that about eight streets will be paved next spring.

Lancaster, O.—A resolution has been adopted authorizing the city engineer to prepare plans and specifications for paving Ewing st.

Portsmouth, O.—The city council contemplates paving all the principal alleys in the city next spring.

Toledo, O.—Concrete work is contemplated and bids will soon be requested.

Wellsville, O.—Plans for the paving of Virgin alley, from Riverside ave. to Broadway, have been approved by the city council.

Toronto, Ont.—Paving is contemplated for Wellesley Lane, Grand View, Hampton, Strachan and Pacific aves., Dovercourt road, Sackville and St. Vincent sts.

Zanesville, O.—An ordinance for paving Locust ave. has been passed. A. H. Correll, mayor.

Oklahoma City, Okla. — Resolutions have been passed for paving 17th, Olie and Wheeler sts.

Tulsa, Okla.—Bids will shortly be asked for the paving of about 85 blocks of streets, asphalt, at an estimated cost of $317,175. T. C. Hughes, cy. engr.

Portland, Ore.—The citizens of the state will vote in November on the issue of bonds for constructing roads.

Amarillo, Tex.—The $70,000 issue of paving bonds has been sold and bids will be asked soon.

Dallas, Tex.—The paving, with Jacksboro rock, of Rawlins st., from Oak Lawn ave. to Coke st., and Coke st., from Rawlins to Hall st., has been ordered by the municipal commissioners.

Dallas, Tex.—Resolutions have been adopted for paving Holme st. and Grand ave. J. B. Winslett, cy. secty.

Haskell, Tex.—A $100,000 county bond issue for good roads will be voted Dec. 8.

Munday, Tex.—This city voted to issue $5,000 bonds for street improvements.

Bellingham, Wash.—New bids will be asked soon for paving Grant st.

Waterville, Wash.—A 13-mile macadam road to cost $25,000 will be constructed from Columbia river to Rock Island.

Milwaukee, Wis.—A municipal asphalt plant will be built next year; to cost about $5,000.

Front Royal, Va.—Voted to issue $30,000 bonds for road improvements.

Jonesville, Va.—Lee county will vote, Nov. 29, on $350,000 bonds for road construction.

New Westminster, B. C.—A resolution has been passed for construction of cement and concrete sidewalks, paving roadway and boulevard.

CONTRACTS TO BE LET.

Pine Bluff, Ark.—Bids will be received Dec. 5 for constructing and repairing 9.6 miles of gravel road together with necessary culverts and cross drains. Estimated cost $41,000. W. J. Parkes, 107½ Main st., Pine Bluff, Ark., engr.

Perry, Fla.—Bids will be received on Dec. 5 for the construction of 400 to 800 sq. yds. of cement sidewalk for court house walks. John C. Calhoun, clk.

Jeffersonville, Ind.—Bids will be received on Dec. 5 until 10 a. m. for the construction of a gravel road in Bethlehem township. Peter Nachaud, aud.

Kokomo, Ind.—Bids will be received on Dec. 7 for the construction of gravel road in Center township and one on line dividing Harrison and Honey creek townships. E. B. Esterling, aud.

Lafayette, Ind.—Bids will be received on Dec. 9 until 10 a. m. for the construction of a gravel road in Wabash township. John P. Foreman, aud.

Liberty, Ind.—Bids will be received on Dec. 5 until 2 p. m. for construction of a gravel road in Center township. Clinton Gardner, aud.

Logansport, Ind.—Bids will be received Dec. 7 until 10 a. m. for construction of the Thomas J. Wisely road in Boone township. Bonds required. Geo. W. Conn, audt.

Logansport, Ind.—Bids will be received until 10 a. m. for construction of the Charles E. Beckley road in Boone township. Bond required. Geo. W. Conn, audt.

Logansport, Ind. — Bids will be received Dec. 7 until 10 a. m. for construction of the Melvin Tucker road in Harrison township. Bond required. Geo. W. Conn, audt.

Logansport, Ind.—Bids will be received Dec. 6 until 10 a. m. for the construction of the Charles E. Wolf road, in Boone township. Bond required. Geo. W. Conn, audt.

Peru, Ind.—Bids will be received on Dec. 6 for the construction of 3 gravel roads in Washington township. Charles Griswold, audt.

Rensselaer, Ind.—Bids will be received on Dec. 6 until 12 m. for construction of fine stone road improvements in Kenner township. James N. Leatherman, audt.

Scottsburg, Ind.—Bids will be received on Dec. 5 for the construction of 2 gravel roads in Lexington township. Frank Gardner, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 10 a. m. for furnishing all material and the construction of 2½ mis. of Purdy free gravel road, in Pawpaw township. Bond required. J. P. Noftzger, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 10 a. m. for improvement by grading and macadamizing of highways in Noble township, J. W. Murphy et al. gravel road and the Herman Wolf et al. gravel road. Personal or surety bond required. J. P. Noftzger, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 1 p. m. for furnishing of material and construction of 3 miles of the Hoover free gravel road, in Chester township. Bond required. J. P. Noftzger, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 10 a. m. for improvement of highway known as the Samuel E. Eby et al., in Pawpaw township. Personal or surety bond. J. P. Noftzger, audt.

Williamsport, Ind.—Bids will be received on Dec. 5 until 1 p. m. for construction of a gravel road in Jordan township. R. C. Winks, audt.

Williamsport, Ind.—Bids will be received on Dec. 10 for the construction of gravel road in Pine township. P. L. Winks, audt.

Ft. St. Philip, La.—Bids will be received on Dec. 7 until 11 a. m. for the construction of roads and walks at Ft. St. Philip. George B. Davis, Q. M., Hibernia Bank bldg., New Orleans, La.

New Orleans, La.—Bids will be received on Nov. 29, for paving with small granite blocks on a concrete foundation the roadway on the river front from Thalia to Bienville sts. Hugh McCloskey, prest. bd. comrs.

Crookston, Minn.—Bids will be received on Dec. 18 until 8 p. m. for paving Ash and Thirteenth sts. with asphalt. A. M. Childs, cy. clk.

Gulfport, Miss.—Bids will be received on Dec. 6 for furnishing material and constructing about 10,000 sq. yds. cement sidewalk. Louis M. Hudson, st. comr.

New York, N. Y.—Bids will be received on Dec. 8 until 3 p. m. for furnishing material and labor for resurfacing the speedway of Ocean Parkway, between Ave. J. and King's Highway, boro of Brooklyn. Chas. B. Stover, prest.

Cincinnati, O.—Bids will be received on Dec. 6 for improving Hill road. F. Dreihs.

Cincinnati, O.—Bids will be received on Dec. 2 for improving North Bend road, from Harrison pike to north corporation line of village of Cheviot. F. Dreihs.

CONTRACTS AWARDED.

Birmingham, Ala.—The contracts for brick paving and sidewalks were awarded to F. W. Jordan Construction Co.; $54,850.

Florence, Ala.—Contract for the building of sidewalks on Cypress Hills road was awarded to J. H. Angel & Co.

Montgomery, Ala.—The contract for paving Madison ave. was awarded to the Southern Bitulithic Co.

Montgomery, Ala.—The contract for paving sidewalks was awarded to J. S. Connift & Co.; $24,000.

Little Rock, Ark.—The contract for paving portions of Rock and Scott sts. was awarded to M. D. L. Cook; $40,000.

Phoenix, Ariz.—The contract for construction of highway was awarded to R. Toobey & Sons, Phoenix, for $55,000.

Little Rock, Ark.—The contract for paving Rock and Scott sts. from 4th to 15th, with asphalt concrete, was awarded to M. D. L. Cook for $40,000, and the contract for paving Main st., from Markham to 10th sts., with wooden blocks, to E. J. Wetterstrom, of Chicago, Ill., for $50,000.

Los Angeles, Cal.—The contract for paving with asphalt on South Park ave., from Jefferson to 58th st., cement curb and vitrified block gutter, was awarded to Fairchild-Gilmore-Wilton Co., Pacific Electric bldg., for $73,458.

Los Angeles, Cal.—The contract for street improvements was awarded to L. H. McGowan, for $11,289.

Los Angeles, Cal.—The board of public works has awarded the contract to Earl F. Low, 240 S. Hill st., at $7,727, for improving Figueroa st.

Los Angeles, Cal.—The contract for grading, graveling, cement gutter and vitrified block gutter was awarded to Geo. H. Oswald, for $7,268.

Oakland, Cal.—The contract for paving with Hassam pavement the 12th st. dam was award to the Covault Co.; $8,438.

Riverside, Cal.—The Star Cement Co. was awarded the contract for improving Lime st., at $7,723.

Riverside, Cal.—The contract for macadamizing Pepper st. was awarded to Shull-Tucker Co., at $9,789.

Sacramento, Cal.—The contract for constructing 2 miles of street in Maple Park division was awarded to Piedmont Construction Co., of Oakland; $90,000.

San Diego, Cal.—The contract for paving D st., from 15th to 25th, was awarded to Fairchilds-Gilmore-Wilton Co., Pacific Electric bldg., Los Angeles, $26,131.

San Francisco, Cal.—The contract for an asphalt road between Lombard st. gate and guardhouse, at the Presidio, was awarded to Flinn & Treacy, San Francisco, Cal.; $9,900.

San Francisco, Cal.—The contract for laying asphalt pavement at the Presidio was awarded to Flinn & Treacy, San Francisco, Cal.; $9,900.

San Jose, Cal.—The contract for road improvements was awarded to F. W. Wehner, at $9,000.

Denver, Colo.—The contract for the work in South Denver improvement district No. 7, including grading and concrete curb and gutter, was awarded to J. F. Roberts; $40,981.

Canaan, Conn.—The contract for 3,000 lin. ft. of gravel-telford road, on the Point of Rocks road, including one reinforced concrete arch culvert, was awarded to T. H. Gill Co., Winter Hill Station, Boston, Mass.

Danbury, Conn.—The contract for 5,550 lin. ft. of gravel-telford road, on the Norwalk-Danbury turnpike, was awarded to the Lane Construction Corporation, Meriden, Conn.

Naugatuck, Conn.—The contract for 3,300 lin. ft. of gravel-telford road, 2 12-in. and 1 24-in. tile culverts, was awarded to the Lane Construction Corporation, Meriden, Conn.

Norfolk, Conn.—The contract for 6,400 lin. ft. of gravel-telford road, on the Norfolk-Winsted turnpike, 3 12-in. and 3 15-in. tile culverts, was awarded to A. D. Bridge's Sons, Inc., Hazardville, Conn.

Plainfield, Conn.—The contract for 11,230 lin. ft. gravel-telford road, on the Plainfield-Jewett City turnpike, was awarded to Jones & Polcaro, Willimantic, Conn.

Redding, Conn.—The contract for 3,241 lin. ft. gravel-telford road, including 2 12-in. and 2 24-in. tile culverts, on the Danbury-Norwalk turnpike, was awarded to Jenks & Goepple, Wilton, Conn.

Ridgefield, Conn.—The contract for 11,997 lin. ft. gravel-telford road, including 4 12-in., 3 15-in., 1 18-in. and 2 14-in. tile culverts, and 5 reinforced concrete arch culverts, was awarded to O. T. Benedict, Pittsfield, Mass.

Southbury, Conn.—The contract for 5,055 lin. ft. of gravel-telford road, 3 15-in. and 1 24-in. tile culverts, was awarded to Chas. W. Tryon, Meriden, Conn.

Fort Dade (Egmont Postoffice), Fla.—The Edwards Construction Co., of Tampa, Fla., has been awarded the contract, at $7,913, for furnishing 33,200 sq. ft. of concrete road and 2,650 sq. ft. of concrete walk at Fort Dade.

East St. Louis, Ill.—Paving contracts were awarded, Oct. 20, as follows: Paving alley between 12th and 13th sts. and College ave. and State st., $4,688, and improving Rock road from 9th to 19th st., $2,917, Meyer Construction Co., of St. Louis; improving Brady ave., C. A. Horn, of East St. Louis, $21,923; Kansas ave., Gaynard & Sweeney, of East St. Louis, $7,832.

Galesburg, Ill.—The contract for laying S. Seminary pavement was awarded to J. B. McAuley, at $26,859.

Harvey, Ill.—The contract for paving with brick on Columbia ave. was awarded to Smith & Brown, Chicago, Ill.

Highland Park, Ill.—The contract for

paving Gage ave. with macadam was awarded to the Schmidt Construction Co., at $5,629.

Peoria, Ill.—Work on the paving of S. Adams st., from Bridge to Hamilton sts., with creosote blocks, is to be started immediately, the board of local improvement having awarded the contract at a meeting held recently to Brewster & Evans, of Peoria, at $34,491. This was the lowest bid of the six received. George F. Simmons, prest. of bd.

Bloomfield, Ind.—The contracts for construction of gravel roads were awarded as follows: Elliott road, in Washington township, to Frank Musselman, Newberry, $4,605; Clayton road, in Stockton township, to Fred Carpenter and R. M. Stafford, Lyons, $4,600, and the Davhoff roads, in Jefferson township, to Samuel Hayes, Worthington, $5,298.

Bloomfield, Ind.—The contract for construction of gravel road was awarded to Thomas E. Slinkard, of Lyons, at $11,111.

Danville, Ind.—The contract for road construction was awarded to McMahon & Co., Fortville, at $25,258.

Wabash, Ind.—The contract for construction of gravel road was awarded to C. M. Wales, of Converse, at $7,825.

Fort Scott, Kans.—The paving of Market square was awarded to the Midland Construction Co., 1,600 sq. yds., $1 per yard; Main st., to same, 10,824 yds.; total, $15,484.84.

Junction City, Kans.—The contract for paving 10½ blocks in residence section was awarded to Flower Bros.; $32,000.

Olathe, Kans.—The contract for constructing 4½ miles of rock road was awarded to Ransom & Cook, of Ottawa, Kans., for $30,456.

Crowley, La.—The contracts for concrete crossings and for walks connecting up crossings were awarded to De Jersey & Barnard, Crowley.

Boston, Mass.—The contract for macadam road in Addison st. was awarded to James Doherty, 133 Calumet st., Roxbury; $14,049.

Boston, Mass.—The contract for paving with asphalt Massachusetts ave. was awarded to Warren Bros. Co., at $8,499.

Boston, Mass.—The contract for construction of vitrified brick pavement at the navy yard was awarded to Central Construction Co., of Boston; $7,381.

Flint, Mich.—The contract for brick paving, with asphalt filler, was awarded to J. T. Lynch, at $8,805.

Rochester, Minn.—Eight blocks of curbing and paving on Broadway were awarded to the Kettle River Co., Minneapolis; $62,353.59.

Tarkio, Mo.—The contract for paving Main st. was awarded to Wellman & Olson, St. Joseph; $25,000.

Omaha, Neb.—The contract for repaving Broadway, from 1st to 6th sts., with Galesburg blocks, was awarded to E. A. Wickham, at $27,030, and contracts for paving, amounting to $70,000, were awarded to National Construction Co.

Portsmouth, N. H.—The contract for paving Islington st. was awarded to Thos. Fitzgibbon, Beverly, Mass.; $4,300.

Asbury Park, N. J.—The contract for 8,450 sq. yds. of wood block paving on Cookman ave. was awarded to United States Wood Preserving Co., 165 Broadway, New York, N. Y.; $21,336.

Newark, N. J.—The contract for building new road near the city was awarded to the Horrigan Contracting Co., at $1,680.

Newark, N. J.—The contract for paving Union ave., Belleville, was awarded to Philip and Peter Jannarone, at $13,434; paving Gregory ave., West Orange, Donato Fusco, at $13,833.

Westfield, N. J.—Contracts for street improvements were awarded as follows: 4,000 cu. yds. excavation; 4,910 sq. yds. 6-in. and 10,200 sq. yds. 4-in. macadam; 3,860 lin. ft. concrete curb and gutter, etc., to Weldon Construction Co., Rahway; 3,630 sq. yds. 6-in. and 4,500 sq. yds. 4-in. macadam and 7,080 sq. yds. macadam resurfaced, all with Tarvia X binder; 5,700 lin. ft. concrete curb and gutter, etc., to Daniel Donovan, 140 W. 25th st., Bayonne; 980 lin. ft. vitrified brick gutters, 1,150 lin. ft. curb reset, and 1,610 lin. ft. new curb, to Monroe Paving Co., 509 Betz bldg., Philadelphia.

Albany, N. Y.—The contract for the improvement of Myrtle ave. was awarded to Henry Dumary; $12,218.

Bronxville, N. Y.—The contract for paving Avon road, in Sagamore, and constructing sewers thereon, was awarded to Bellew & Merritt, at $16,486.

Fairport, N. Y.—The contract for construction of sewers in South Main and Polk sts, was awarded to Wagner & Dancy, East Rochester.

Chardon, O.—The contract for paving one mile of road in Hampton township was awarded to the Cement Products Co., Erie, Pa.

Clyde, O.—The paving of part of Amanda and Buckeye sts. with Deckman-Duty brick was awarded to J. C. Smith, Lorain, O.

Eaton, O.—The contract for paving various streets with Paris stone was awarded to Jenkins & Hines, Frankfort, Ind.; $10,500.

Marysville, O.—The contract for the improvement of the public highway south of Milford Center was awarded to Welsh & Jones, at $4,500.

Toledo, O.—The contract for paving various streets with bituminous macadam, Carbo Via treatment, was awarded to France Co., Toledo, at $21,621.

Ft. Sill, Okla.—The contract for concrete walks was awarded to J. R. Laughlin, Topeka, Kans., at $5,257.

La Grande, Ore.—The contract for the paving of 4th st., from Adams to O st., was awarded to the Warren Construction Co., Portland, Ore.

Portland, Ore.—The following contracts have been awarded: Street paving, to Warren Construction Co., Beck bldg., $19,622; grading and concrete curbs, to Stevens Bros., 590 E. 10th st., $2,494; grading and concrete curbs, to M. Houson, 523 Grant st., $6,573.

Kitanning, Pa.—The contract for brick and macadam paving and also concrete curbing was awarded to John Schaffner, Butler; $39,592.

Philadelphia, Pa.—Contracts have been awarded as follows: Paving 35 sts., to Barber Asphalt Paving Co., Land Title bldg.; paving 10 sts., to Filbert Paving & Construction Co., Penn bldg. Improvements will aggregate $100,000.

Punxsutawney, Pa.—The contract for street paving was awarded to P. E. and P. J. McGovern, at $12,342.

Memphis, Tenn.—The contract for paving Peabody ave. has been awarded to the Memphis Asphalt & Paving Co., at $35,260, and H. P. Streicher & Co. received the contract for the extension of Madison ave. from Cooper st. to the Parkway, at $19,130. Asphalt will be used on both streets.

Galveston, Tex.—The contract for constructing shell road from Missouri City,

Richmond, Tex., was awarded to W. D. Haden, at $81,745.

Puyallup, Wash.—The contract for the paving of Poplar st. was awarded to the Warren Construction Co., Portland, Ore.

Seattle, Wash.—Contracts for street improvements have been awarded as follows: Planking Oliver st., Wm. Kopka, city, $9,496; concrete walks, Whitman ave., Packard Spring Co., city, $25,768; brick paving and granite curbing, 3rd ave., Grant Smith & Co. & Stillwell, city, $81,000.

Seattle, Wash.—The following contracts have been awarded: Improving Lane st. and others, to W. H. Smith, $6,623; Green st., from Rainier ave. to 32d ave., South, to Rufus Buck, $5,803; Rainier ave., from 57th ave., South, to Ryan st., to Anderson, Peterson & Co., $34,802.

Tacoma, Wash.—The following contracts have been awarded: Construction of walks in district 733, to Smith Cement and Brick Co., 722 Commerce st.; for walks and grading in district No. 777, to Pacific Fuel Co., 1950 South C st.

St. Catherines, Ont.—The contracts for the paving of Queenston and King sts. were awarded to the Warren Paving Co., of Toronto, Canada, at $59,000.

SEWERS.

CONTEMPLATED WORK.

Birmingham, Ala.—A storm sewer, to cost about $300,000, is contemplated.

Tucson, Ariz.—The city clerk has been instructed to let contract for 23,000 ft. of sewer pipe and fittings.

Orange, Cal.—It has been decided to lay sewers in Chapman ave., Cypress, Lemon and various other streets.

San Francisco, Cal.—The board of supervisors has authorized construction of sewers in section C2 of North Point main sewer system; cost, $85,000.

Los Angeles, Cal.—The residents and property owners in San Pedro have petitioned the city council to construct a storm sewer system for the protection of the business district of that part of Greater Los Angeles.

Monrovita, Cal.—A $120,000 bond issue for sewers has been voted.

Winsted, Conn.—This city voted to install a sewer system. Borough warden.

Macon, Ga.—Consulting Engineer J. W. Wilcox has completed plans for 1 mile of sewers.

Rome, Ga.—A $50,000 bond issue for sewers will be voted on Dec. 6.

Nampa, Idaho.—A sewer system, consisting of 8-in. to 15-in. vitrified pipe, is contemplated. It is said that bids on part of the work will be received about Jan. 1.

Sigourney, Ia.—A bond issue of $35,000 has been voted for the construction of a sewer system.

Paris, Ill.—A bond issue of $15,000 has been voted for sewer on Big Four right of way. Cy. clk.

Seymour, Ind.—Bids will be received by board of public works for the laying of 400 lin. ft. of 12-in. vitrified pipe sewer.

South Bend, Ind.—Plans are being designed and bids will be asked by Jan. 1 for installing a trunk sewer system in the southern part of this city. Wm. S. Moore, cy. engr.

Lyons, Kans.—Plans are in progress for complete sewer system, consisting of 8 miles of sewers and laterals, 8 to 15-in. pipe. Cost, $65,000.

Easton, Md.—Plans for sewers and sewage disposal works will be made by Clyde Potts, 30 Church st., New York.

Dawson Springs, Ky.—An engineer is wanted to design a small system of sewers. Town clerk.

Boston, Mass.—It is reported that the street and water commission will construct sewers in Edmund and Woodlane sts.

Battle Creek, Mich.—A sewer system has been decided upon. Cost, about $6,000.

Detroit, Mich.—Bids for the construction of lateral sewer will be advertised for soon. J. J. Haarer, comr.

Grosse Pointe Park, Mich.—Plans will be prepared for constructing a sewerage system. Vil. trustees.

Brainerd, Minn.—All bids for sewer in districts Nos. 4 and 5 have been rejected.

Owatonna, Minn.—Will vote, Nov. 8, on the issue of $30,000 sewer and paving bonds.

South St. Paul, Minn.—An extension of the Grand ave. sewer, a distance of about 40 blks., is under consideration.

Virginia, Minn.—An ordinance has been passed providing for the establishment of a sewer district, No. 4.

Meridian, Miss.—Bonds to the total of $60,000 for sewer and drainage extensions have been sold.

Cameron, Mo.—Plans for 8 and 10-in. lateral sewers have been prepared by Engineers Seit & Peterman, Corby bldg., St. Joseph, Mo.

Mexico, Mo.—Plans for 3,000 ft. of sewer are being prepared. E. F. Ketler, cy. engr.

Conrad, Mont.—Bids will soon be asked for the construction of a sewer system.

Whitefish, Mont.—Engineer Jaquith will have plans completed by Dec. 1 for sewer system here.

Madison, N. J.—It has been decided to lay the sewers on Madison ave. up to Loantaka instead of Morris Place.

Newark, N. J.—Ordinances have been passed for concrete sewers on Thomas and Dawson sts. and Avenue C. Bd. of st. and water comrs.; M. R. Sherrerd, chief engr.

Port Jefferson (L. I.), N. Y.—The installation of a sewerage system is contemplated, and a committee has been appointed to circulate a petition among the property owners.

Port Jervis, N. Y.—A sewer will be laid on Richard ave.

Rochester, N. Y.—A public hearing was held Oct. 19 on the ordinance appropriating $500,000 for the purpose of constructing intercepting sewers, as a part of the proposed plan for sewage disposal and to avoid pollution of the lower river.

Rome, N. Y.—Plans for a $1,000 sewer extension have been prepared. Cy. engr. Plunkett.

Yorkville, N. Y.—Voted in favor of the proposition for constructing a sewer system which will cost about $22,000.

Ashtabula, O.—Plans are being prepared for a sewer in Middle st.

Cincinnati, O.—Plans for $14,043 of sewer construction have been prepared by Cy. Engr. Shipley.

Cleveland, O.—About Dec. 1 bids will be received for the construction of a brick and concrete sewer. I. A. Greenwood, 307 City Hall.

Lancaster, O.—The city engineer has been directed to prepare plans and specifications for constructing sewers in Frederick st. and the Wm. Cox addition.

Portsmouth, O.—Bids will be asked

early this month for a new sewer between 3d and 4th sts.

Wilmington, O.—The construction of a drainage and sewerage system is contemplated at a cost of about $90,000.

Newburg, Ore.—Voted, Oct. 4, to install a sewerage system.

Portland, Ore.—The city engineer has prepared plans for sewers in the following streets: Curlett, Texas and others.

Portland, Ore.—Bids will soon be asked for construction of Holgate sewer extension in Brooklyn district.

Allentown, Pa.—A committee of 15 has been appointed, with Col. Harry C. Trexler, chairman, to devise a plan for constructing a sewerage system.

Beaver Falls, Pa.—Preliminary work on a complete sewer system is to start soon. Bids have been received on the engineering work.

Carbondale, Pa.—About $50,000 will be expended for pipe sewers. Engr. B. D. Anthony, Carbondale.

Lansdowne, Pa.—The construction of a sewage disposal plant is being considered for the sewage of the boroughs of Lansdowne, Yeadon, Aldan, Clifton Heights and other municipalities.

Marcus Hook, Pa.—An ordinance has been passed for constructing a sewer in E. 9th st. R. L. Elliott, prest. of coun.

Masontown, Pa.—The citizens have voted $25,000 of bonds for water works and sewer systems.

McKeesport, Pa.—The city engineer has been instructed to prepare plans for a sewer system, as required by the state bd. of health.

New Philadelphia, Pa.—Plans for construction of a sewer system will be completed about Nov. 15. Geo. E. Arnold, cy. engr.

Mitchell, S. D.—The contract for constructing 9,929 ft. of 8-in. pipe sewers and 25 manholes was awarded to E. L. Dimick, Laurel, Neb.; $6,492.

Dallas, Tex.—Plans for a storm sewer on Swiss ave. have been adopted by the cy. commrs.

Bryan, Tex.—The city council has agreed to begin work at once on the municipal sewer system.

Ft. Worth, Tex.—Plans for a large sewer system are being prepared.

Richmond, Va.—Bids will be asked soon for the following sewers: Lombard st., $33,560; Sycamore st., $38,488; Meadow st., $439,689; Hampton st., $68,-138. Chas. E. Bolling, cy. engr.

Chehalis, Wash.—City council passed ordinance authorizing the installation of a $55,000 sewer system. The contracts will not be let till spring.

Everett, Wash.—It is reported that Phillips & Son will be awarded the contract to construct a sewer in Maple st.; $3,035.

Olympia, Wash.—The city engineer will complete the Swanton sewer.

Vancouver, Wash.—City Engineer H. H. Latta has plans under way for trunk and lateral sewers, amounting to $50,000 or $75,000.

Moundville, W. Va.—A bond issue of $166,900 has been voted for a sewer system. Engineer not yet selected. O. B. Boner, cy. clk.

Laramie, Wyo.—Voted in November on the issue of $15,000 for improving the sewer system.

New Westminster, B. C.—A resolution has been passed providing for construction of storm sewers on 3rd st., from Royal ave. to 6th ave.

Waterville, Ont.—Considering the construction of sewage disposal plant.

CONTRACTS TO BE LET.

Elwood, Ind.—Bids are being received for sewer, 1,000 ft. long, in West South K st. and 13th. John Nearon, clk.

Shelbyville, Ind.—Bids will be received on Dec. 29 for construction of sanitary sewer system. L. E. Webb, cy. clk.

Louisville, Ky.—Bids will be received on Dec. 2 for construction of a sewer known as 8th and St. Catherine sts. sewers. J. B. F. Breed, chief engr.

Louisville, Ky.—Bids will be received on Dec. 2 for construction of sewers. P. L. Atherton.

Springfield, Minn.—Bids will be received on Dec. 2 for the construction of a 370-ft. 8-in. branch sewer in O'Connell st. John A. Eichmann, recdr.

Newark, N. J.—Bids will be received on Dec. 1 until 3:15 p. m. for the construction of a storm water sewer in Ave. C and Dawson st. Bd. of st. and water commrs.

Brooklyn, N. Y.—Bids will be received on Dec. 7 until 11 a. m. for the construction of sewers in various streets. Alfred E. Steers, prest. boro of Brooklyn.

Newburg, N. Y.—Bids will be received on Dec. 5 until 5 p. m. for the construction of a trunk sewer in Lake st. and lateral in Broadway to Lake st. Wm. J. Blake, cy. engr.

Akron, O.—Bids will be received on Dec. 1 until 12 m. for the installation of sewer in and along Euclid ave., from Schell to Wabash ave. Cy. clk.

Timmonsville, S. C.—Bids will be received Dec. 7 for building a storm water drainage, approximating 6,000 ft. of lateral drains, brick and concrete and terra cotta pipe, from 12 to 36 in. diameter, including manholes, catchbasins, etc. R. C. Collins, cy. clk.

Olympia, Wash.—Bids will be received on Dec. 23 until 5 p. m. for laying a sewer in the alley running north and south through block 14. J. R. Dever, cy. clk.

Buffalo, Wyo.—Bids will be received on Jan. 6 until 8 p. m. for furnishing material and labor for a sewerage system. Mayor and bd. of trustees, Buffalo, Wyo.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for sewer construction was awarded to David Jay, at $25,000.

Los Angeles, Cal.—The contract for sewer construction was awarded to M. Sale, at $6,989.

Ft. Winfield Scott, Cal.—The contract for sewer and water extensions was awarded to K. Ehrhart, San Francisco; $10,255.

Los Angeles, Cal.—The contract for construction of a public sewer was awarded to M. Salas, at $6,989.

Oakland, Cal.—The contract for a sewer in 14th ave. was awarded to Scott & Foley; $13,597.

Denver, Colo.—The contract for subdistrict 2, of South Hill storm sewer district No. 2, was awarded to Westcott Doan Investment Co.; $4,752. Seventh ave. special sanitary sewer district, to Westcott Doan Investment Co.; $7,894.

Denver, Colo.—The contract for subdistrict 9, of East Side sanitary sewer district No. 1, was awarded to Municipal Construction Co.; $22,167.

Denver, Colo.—The contract for sanitary sewer and other improvements was awarded to Westcott-Doan Investment Co., for $12,646.

Newark, Del.—The contract for a sewage disposal plant for the Continental

Fiber Co. was awarded to L. B. Jacobs, Newark, Del.

Clearwater, Fla.—The contract for 2¼ miles of 8 to 15-in. pipe sewer, 4 appurtenances, was awarded to Ira C. Nicholas, of Kissimee, Fla.; $8,000.

Eastman, Ga.—The contract for a sewer system was awarded to F. M. Benner, Marion, Ind.

West Liberty, Ia.—The contract for construction of six miles of sanitary sewers and sewage disposal plant was awarded to C. R. Nichols, Caney, Kans., at $28,655.

Lewiston, Ill.—The contract for construction of sewer and septic tank was awarded to J. E. Bailey, Hamilton, O., at $15,295.

Waukegan, Ill.—The contract for a sewer in Washburn Park was awarded to William Maren, Joliet, Ill., at $17,724.

West Liberty, Ia.—The contract for a sewer system was awarded to C. R. Nichols, Carey, Kans., at $28,684.

Louisville, Ky.—The contract for the construction of section B of Frankfort ave. sewer was awarded to James Ferry & Sons, Pittsburg, Pa., at $25,000.

Albert Lea, Minn.—The contract for constructing sewers in various streets was awarded to Ilstrup & Olson, of Minneapolis, at $5,799.

Duluth, Minn.—The contract for a sewer in 61st alley, west, was awarded to Chas. Ekland, at $3,242, and the sewer in 39th ave., west, was awarded to W. E. Kern, at $4,805.

Neosho, Mo.—The contract for a sewer in district No. 1 was awarded to the United States Construction Co., Vinita, Okla., at $34,950.

Sedalia, Mo.—The contract for a sewer in district No. 43 was awarded to G. W. & A. H. Kemp.

Caro, Mich.—The contract for constructing about 10,055 lin. ft. of 8 to 15-in. sewer was awarded to James W. Collins, of Flint, at $7,392.

Detroit, Mich.—The contract for Fairview public sewer in Jefferson ave. was awarded to Langely & Jaynes, for $55,587.

Detroit. Mich.—The contract for lateral sewer was awarded to Thos. Whittaker, Detroit, Mich., for $8,708.

Bloomfield, N. J.—The contract for Watsessing storm sewer was awarded to Jas. J. Boylan; $10,781.

South Amboy, N. J.—The contract for a sewer in South Amboy was awarded to P. J. Monahan, South Amboy, N. J., at $26,750.

Sumpter, S. C.—The contract for construction of sewers was awarded to Bingham & Moffitt, of Orangeburg, S. C., for $10,630.

Fairport, N. Y.—The contract for sewers in South Main and Park sts. was awarded to Wagner & Daucey, East Rochester, N. Y.

Niagara Falls, N. Y.—The contract for a sewer in Garfield ave. and one along the New York Central R. R., north of Suspension Bridge, was awarded to the Read-Coddington Engineering Co., at $92,050.

Bellefontaine, O.—The contract for a new sewage system, section 1, was awarded to E. C. McConnell, Kenton, O., $31,503; section 2 was awarded to William McDowell & Son, Cleveland, O., $33,594.

Dayton, O.—The contract for storm sewer in Central ave. and 7th st. was awarded to Hall & Cronin Co., at $22,694.

Carthage, O.—The contract for laying sewers was awarded to John Snyder, Nagood, at $46,000.

Cincinnati, O.—The contract for main and lateral sewers in Marshall ave., Gilmore st., etc., was awarded to Kirchner Construction Co., 800 Plum st., Cincinnati; $54,791.

Cleveland, O.—The contract for drainage system was awarded to Hoag & Zulla; $25,800.

Hamilton, O.—The contract for construction of storm sewer in Millikin st. was awarded to Frank J. Davis, of Hamilton, O.; $5,030.

Hamilton, O.—The contract for construction of a storm sewer in Central ave. and 7th st. was awarded to Hall, Cronin & Co., of Dayton, O.; $22,694.

Hamilton, O.—The contract for construction of storm sewer in 4th, 5th and Vine sts. was awarded to Graver Construction Co.; $15,412.

Youngstown, O.—The contract for construction of Ardale and Wirt sts. sewer was awarded to Hannon Bros.; $12,214.

Youngstown, O.—The contract for construction of Logan ave. sewer was awarded to W. E. Gartland; $15,529.

Youngstown, O.—The contract for a sewer in Phelps st. was awarded to Jno. Grady; $21,013.

Muskogee, Okla.—The contract for construction of storm sewer was awarded to F. P. McCormick, at $57,476.

Neosho, Okla.—The contract for a sewer system was awarded to United Construction Co., Neosho, Okla.; $34,905.

Salem, Ore.—The contract for construction of South Salem sewer system was awarded to Bebee & Stevenson, at $175,000.

Portland, Ore.—The contract for constructing the Riverside sewer was awarded to William Lind, Portland, at $132,005.

Portland, Ore.—The contract for the Laurelhurst addition sewer was awarded to the Barber Asphalt Paving Co., at $41,000.

Portland, Ore.—The contract for the Riverside sewer; reinforced concrete sewer, 7,069 lin. ft., 24 to 43 in.; drain tile, 3,000 lin. ft., 4 to 8 in.; cement sewer, 63,696 lin. ft., 6 to 24 in.; branches on concrete sewer pipe, 1,217 lin. ft.; 1,212 ⅛ bends, 6 in.; 46 manholes; 84 manholes, complete; 19 drop manholes; 69,972 cu. yds. excavation and refilling; 211 concrete inlets, complete; 210 cu. yds. concrete; 1,000 vitrified brick; 100 lbs. steel; 1,050 lin. ft. platform; 170-ft. tunnel; 8,480 lin. ft. piling, left in place; 1,272 lin. ft. piling above cut-off, was awarded to William Lind, 525 E. 16th st., N. Portland, Ore.

Chester, Pa.—The contract for the sewer and water connections with water main in center of street was awarded to J. A. Morgan, 1032 W. 3rd st.

Providence, R. I.—The contract for construction of two sewers was awarded to Chas. Crankshaw, 400 Plainfield st.; $13,717.

Providence, R. I.—The contract for construction of sewers in various streets was awarded to F. E. Shaw, at $27,531.

Pasco, Wash.—The contract for construction of modern sewerage system was awarded to the Newport Engineering Co., of Portland, Ore., for about $66,226.

Prosser, Wash.—The contract for construction of sewer system was awarded to Atlas Construction Co., Everett, Wash.; $17,811.

Snohomish, Wash.—The contract for the Maple st. sewer, from 5th st. to 1st, and on 1st one block west to trunk sewer, was awarded to Phillips & Son.

New Westminster, B. C.—The contract for laying 20 miles of sewers was awarded to F. T. Sinclair, Revelstoke.

WATER WORKS.

CONTEMPLATED WORK.

Malvern, Ark.—Installation of water works is contemplated.

South Fork, Ark.—Plans are being prepared for a 1,000,000 gallon mechanical filtration plant.

Long Beach, Cal.—Improvement to its present system, including the doubling of its reservoir capacity, is contemplated by the Alamitos Water Co.

Ontario, Cal.—Voted, Oct. 31, to issue $175,000 bonds for new water works.

Daytona, Fla.—City will install 200,000 gallon water softening plant. Geo. A. Main, supt.

Morristown, Ill.—Voted $10,000 bonds for municipal water system.

Newcastle, Ind.—The city is considering improvements to light and water plants.

Adair, Ia.—It has been voted to install a $15,000 water works system.

Frontenac, Kans.—City will build $15,000 water works extension.

Newton, Kans.—Voted bonds for water works improvements.

Stafford, Kans.—Plans have been completed for water works and electric light plant improvements.

Covington, Ky.—Voted, Nov. 8, to issue $100,000 bonds for new reservoir in Devon Park.

Russell, Ky.—Voted to issue $50,000 bonds for water works.

Kenner, La.—It is reported that the St. Charles Land Co. will spend about $150,000 for improvements at Kenner. The work will be the construction of a reservoir, a canal 2½ miles long, also 100 miles of ditches.

Patterson, La.—The city has sold bonds for $30,000 for the construction of water works.

Baltimore, Md.—It is reported that an appropriation of $200,000 has been made for an extra pump at Mt. Royal pumping station.

South Hadley Falls, Mass.—A water system, to cost about $12,000, is contemplated.

Flint, Mich.—Voted, Nov. 8, to issue $400,000 bonds for water works.

Kalamazoo, Mich.—Voted, Nov. 8, to issue $43,000 bonds for water mains.

Minneapolis, Minn.—Proposals for 2 20,000,000 gallon electrically driven turbine type pumps were rejected and will be readvertised. Edw. P. Burch, consulting engr., Minneapolis.

Moorhead, Minn.—Bids will be asked for the drilling of 6, 8 and 10-in. artesian wells, to be dug for the city in connection with the proposed water system.

St. Paul, Minn.—Plans for a concrete bridge at E. 7th and Earl sts. have been completed; $35,000.

Taconite, Minn.—Plans are in progress for water main extension, consisting of 2 miles of c. i. water main, including hydrants, gates and valves. Cost, $15,000.

Granby, Mo.—The erection of a new water works plant, to cost $18,000, is contemplated.

Marionville, Mo.—A water and light system will soon be installed.

Grand Island, Neb.—Plans have been completed for improvements to water works and electric light plant, to cost $100,000. H. E. Clifford, cy. clk.

Norfolk, Neb.—Remodeling, increasing and general improvements to water works system are contemplated.

Wynot, Neb.—Bonds amounting to $8,000 were voted by the citizens for the construction of water works.

Coxsackie, N. Y.—An extension of the water works system is planned.

New York, N. Y.—Bids will be requested within 6 or 8 weeks for construction of aqueduct through Manhattan Island to Bryant Park, to cost about $25,000,000.

Fargo, N. D.—An additional reservoir and one or more artesian wells are to be constructed.

Mandan, N. D.—Plans have been completed for water works improvements, to cost about $65,000.

Defiance, O.—The city council has decided the city shall erect and maintain a municipal water plant.

Celina, O.—New bids will be asked by the board of public affairs for water works extension.

Cincinnati, O.—Four water tanks of 1,500,000 gallons capacity are under consideration for the western hills district. Board of public service.

Cincinnati, O.—The ordinance passed by the council, involving the expenditure of $150,000 for the construction of water mains, was signed by Mayor Schwab.

New Lexington, O.—The council has passed an ordinance granting to James Westwater & Co., of Columbus, O., a franchise to build a system of water works in this village.

Portsmouth, O.—$300,000 of bonds were voted for the construction of new water works.

West Covington, O.—Voted $100,000 bonds for new water works system.

Yukon, Okla.—It is reported that bids will be asked for the construction of a water works and sewer system.

Grant's Pass, Ore.—The construction of a large dam at Savage Rapids is contemplated by the Rogue River Power and Irrigation Co.

Gresham, Ore.—An appropriation of $5,000 has been made for a new water system.

Jacksonville, Ore.—A bond issue of $30,000 for water works has been sold.

Portland, Ore.—Voted $2,500,000 bonds for new system of laying water mains and for the erection of municipal docks.

Vale, Ore.—Taxpayers voted $35,000 in bonds to build a gravity water system. This amount to be added to $75,000 to make the gravity system instead of the pumping plant.

Pittsburg, Pa.—Voted $3,100,000 bonds for water works improvements.

Somerset, Pa.—Water works improvements to cost $25,000 are contemplated.

Wampum, Pa.—Voted $10,000 bonds for building water plant.

Gettysburg, S. D.—A bond issue of $18,000 for water works has been sold.

Hecla, S. D.—Bonds for a water works system have been voted.

Morrison, S. D.—A bond issue of $10,000 for water works has been voted.

Johnson City, Tenn.—The installation of 1,406 ft. of 6-in. water pipe in Willow st. and 2,600 ft. of ¾-in. in Carnegie st. has been ordered.

Austin, Tex.—Bonds for $28,000 for the construction of water works were approved.

Ballinger, Tex.—The city has voted $16,000 of bonds for improving the water works.

North Yakima, Wash.—The construction of two new bridges, to cost $30,000, is contemplated.

Marion, Tex.—The city will construct a water system.

Wortham, Tex.—The city will install an $8,000 water works system.

Ellensburg, Wash.—Municipal water system, to cost $300,000, is contemplated.

Oroville, Wash.—The people voted in favor of establishing a water system.

Seattle, Wash.—An ordinance has been passed providing for the laying of water mains in various streets.

Spokane, Wash.—Water mains will be installed in 27th ave., Courtland st., 5th ave. and 16th ave.

Spokane, Wash.—A concrete reservoir will be erected in Lincoln Heights add. B. of P. W.

Vancouver, Wash.—This city will spend $100,000 for water works improvements.

Walla Walla, Wash.—The laying of water mains in various streets is contemplated.

Yacoit, Wash.—Bids will soon be asked for the construction of a gravity water system. Wm. W. Eaton, cy. clk.

Prescott, Wis.—Voted to install complete water works system.

Cheyenne, Wyo.—The city is considering the construction of a filtration plant. Estimated cost, $50,000.

Laramie, Wyo.—Voted $55,000 bonds for water works.

Rouleau, Sask., Can.—City has voted $45,000 for a water works system.

CONTRACTS TO BE LET.

Sacaton, Ariz.—Bids will be received on Dec. 6 for furnishing and erecting a tank and tower at the Pine Indian school. Commr. of Indian Affairs, Washington, D. C.

Pittsfield, Mass.—Bids will be received on Dec. 12, until 2 p. m. for the construction of a dam and reservoir 7 miles S. E. in Washington, 47 cu. yds. masonry; 85 cu. yds. earth and 9,600 rock excavation, 45 acres clearing and grubbing; 4,000 ft. 12, 20, 24-in. vitrified pipe; 1,300 paving cu. yds. paving. A. B. Farnham, engr. bd. or pub. wks.

Windsor, Mo.—Bids are being received for water works system to cost $39,000 by Rollins & Westover, Beals Bldg., Kansas City, Mo. J. J. Chrisman, cy. clk.

Beatrice, Neb.—Bids are requested for construction of water works system. S. A. Free, cy. c'k.

Cimarron, N. Mex.—Bids are requested until Dec. 20 for a gravity supply system of water works, Cimarron Water Co. Engr. T. W. Jaycox, 1608 Broadway, Denver, Colo.

New York, N. Y.—Bids will be received until Dec. 31 for furnishing, delivering and installing water works apparatus and materials. Bd. of wat. sup.

Niagara Falls, N. Y.—Bids will be received until Dec. 5 for the purchase of city pumping station equipment. Thos. H. Hogan, cy. clk.

Niagara Falls, N. Y.—Bids will be received until Dec. 5 at 3:30 p. m. for the purchase of water works equipment. City engr. 4710 Buffalo ave.

Fayetteville, N. C.—Bids will be received until Dec. 15 for furnishing and installing two filter units of 500,000 gals. per day each, including piping machinery, etc. John K. Strange Fayetteville, N. C.

Pittsburg, Pa.—Bids will be received on Dec. 12 for the construction of a dam and reservoir in the town of Washington. Bd. of pub. wks., Frank Haywood, chrmn.

Timmonsville, S. C.—Bids will be received on Dec. 7 for furnishing material and labor for the construction of water works. J. E. Patterson.

Seattle, Wash.—Bids will be received on Dec. 13 for the construction of water works. P. E. Cunningham, Sultan.

Seattle, Wash.—Bids will be received until Dec. 13 for the sale of city pumps, boilers, etc. C. B. Bagley, sec. bd. pub. wks.

CONTRACTS AWARDED.

Modesto, Cal.—The contract for furnishing and installing the pumps for three pumping stations was awarded to Frederick C. Roberts Co., 461 Market st., at $7,751.

Orland, Cal.—The contract for the construction of schedules 1, 2 and 3 of the earth work of the distribution system, Orland irrigation project was awarded to Marce Bros., Concord, Cal., at $10,738.

Redlands, Cal.—The contract for the construction of dam in Yucaipa Valley was awarded to W. S. Hewitt & Co., $12,000.

Washington, D. C.—The contract for furnishing material for water works system was awarded to Lynchburg Foundry Co., Lynchburg, Va.

Thomaston, Ga.—The contract for furnishing hydrants, pipes and valves in connection with the construction of water works was awarded to Glanmorgan Pipe & Foundry Co., Lynchburg, Va., $25,000.

Beecher, Ill.—The contract for laying 16,570 ft. of 6 and 8-in. water mains was awarded to T. H. Iglehart, Rookery Bldg., Chicago, Ill., $14,177.

Chicago, Ill.—The contract for rebuilding of the 68th st. pumping station, removing old and furnishing new boilers was awarded to Babcock and Wilcox Co., 567 W. Lake st., Chicago, $12,998.

Galesburg, Ill.—The contract for a new fly wheel pump was awarded to Snow Pump Works, Buffalo, N. Y., $16,890.

Highland Park, Ill.—The contract for constructing a cast iron internal main water supply pipe 10-in. in diameter, in Linden and Cedar aves. and Sheridan road was awarded to T. H. Egelbart, Rookery Bldg., $10,113.

Highland Park, Ill.—The contract for constructing a cast iron main water supply pipe, 10-in. in diameter, on Linden and Cedar aves. and Sherman road was awarded to T. H. Iglehart, $10,113.

McLeansboro, Ill.—The contract for the construction of 55,000,000-gallon reservoir was awarded to Retzel & Chapman, Evansville, Ind., $13,934.

Morton, Ill.—The contract for laying 3,000 ft. of water mains in eastern part of town was awarded to A. Everett, Washington, D. C.

Rushville, Ind.—The contract for new boilers at the water and light plants was awarded to Heine Safety Boiler Co., 98 Jackson Blvd., Chicago, Ill., $11,068.

Burlington, Ia.—The contract for furnishing pumps and machinery was awarded to Erie City Iron Works, $14,500.

Chanute, Kan.—The contract for furnishing and laying a 16-in. water main was awarded to G. Jaeger, Rich Hill, Mo., $17,230.

Kingsley, Kan.—The contract for furnishing material and laying water pipe, with hydrants, including 2,500 ft. 6-in. and 11,250 ft. 4-in. cast iron pipe, 8 hydrants and 12 valves was awarded to Marshall Bros., Las Animas, Co'o., $9,775.

Medway, Mass.—The contract for new water works system was awarded to F. A. Hondlitte & Son Co., Boston, $90,000.

Millis, Mass.—The contract for laying water pipe was awarded to Hanscom Construction Co.

Ft. Howard, Md.—The contract for three reinforced cisterns was awarded to Jas. A. Boaz, Philadelphia, $5,600.

Bronson, Mich.—The contract for a water works system was awarded to C. L. Olds Construction Co., Fort Wayne, Ind., $21,000.

Detroit, Mich.—The contract for the erection of the Fairview pumping station was awarded to Hunkin-Conkey Construction Co., Cleveland, O., $150,000.

Fairmount, Minn.—The contract for new steel tank and tower was awarded to Des Moines Bridge and Iron Works, Des Moines, Ia., $5,372.

Owatonna, Minn.—The contract for steam pump at water works was awarded to C. W. Tubby, $5,993.

Beatrice, Neb.—The contract for improvements to water works system, including a 1,000,000 gallon reservoir was awarded to Mathew Construction Co., $57,000.

Hohokus, N. J.—The contract for a water supply system was awarded to Partridge & Howe, White River Plains, N. Y.

Binghamton, N. Y.—The contract for constructing Mt. Prospect reservoir, 59,599 cu. yds. excavation, 770 cu. yds. plain concrete, 2,150 cu. yds. reinforced concrete; 1,090 ft. reinforced concrete fence; 4,650 barrels Portland cement; 280,000 lbs. steel for reinforcement; 56,000 lbs. metal work, furnished by city; 2,100 lbs. cast iron, wrought iron and steel; 2,400 ft. vitrified pipe, 6 in. 250 ft. vitrified pipe, 12-in. was awarded to Sand & Gravel Co., East Liverpool O., $54,329.

Buffalo, N. Y.—The contract for hydrants and valves was awarded to Kennedy Valve Mfg. Co., Elmira, N. Y.

Bowbelles, N. D.—The contract for constructing water works was awarded to Geo. W. Kemper, $11,850.

Canton, O.—The contract for furnishing about 800 tons of cast iron pipe and 10 tons of special castings was awarded to the Massilon Iron & Steel Co., Massillon, O.; $17980.

Hamilton, O.—Contract for various sizes of wrought-iron pipe was awarded to Scioto Valley Supply Co., of Columbus, O., $16,006.

Enid, Okla.—The contract for installing water works was awarded to Laidlaw-Dunn-Gordon Co., Cincinnati, O., $9,740.

Foraker, Okla.—The contract for the construction of water works was awarded to C. A. Rees.

Brookville, Pa.—The contract for a filtration plant for Brookville Water Co., including a concrete dam, filter plant and pumping station was awarded to American Water Softener Co., 1009 Chestnut st., Philadelphia, Pa.

Chambersburg, Pa.—The contract for gravity conduit was awarded to H. C. Brooks Co., of Clarksburg, W. Va., $39,053.

Saegerstown, Pa.—The contract for erecting reservoir, laying water mains was awarded to Henry Keupple, Olean, N. Y.; for pipe and special castings was awarded to United States Cast Iron & Foundry Co.

Sharpsburg, Pa.— The contract for furnishing and installing two 300-h.p. boilers feed water heater, feed pump and piping was awarded to Oil City Boiler Works, Oil City, Pa., $9,353.

Highmore, S. D.—The contract for construction of water works was awarded to Des Moines Bridge & Iron Co., of Des Moines, Ia., for $14,500.

Dallas, Tex.—The contract for erecting pumping station at White Rock reservoir was awarded to Hughes-O'Rourke Construction Co., $30,050.

Galveston, Tex.—The contract for laying the city main across the channel was awarded to A. M. Blodgett Construction Co., $8,000.

Seattle, Wash.—The contract for laying water mains in Alonzo ave., N. W., was awarded to Dicken & Rightmire, 2728 23rd ave. S., $6,142.

Sultan, Wash.—The contract for constructing water works system was awarded to P. E. Cunningham, city, $11,995.

Walworth, Wis.—Contracts for the following were awarded: Water pipe to United States Cast Iron Pipe & Foundry Co., Chicago, Ill.; valves to Ludlow Valve Mfg. Co., Troy, N. Y.; laying pipe to William Tunny, Joliet, Ill.; pumping machinery to Gould Pump Co., Seneca Falls, N. Y.; tank and tower to Chicago Bridge Co., Chicago, Ill.

Highland Park, Va.—Contracts for the following were awarded: Wells, trenches, pump and pump house to I. J. Smith & Co., Richmond, Va. $4,885; hydrants, pipes and valves to Glamorgan Pipe & Iron Co., Lynchburg, $25,000.

Richmond, Va.—The contract for hydrants, pipes and valves was awarded to Glamorgan Pipe & Iron Co., Lynchburg, $25,000.

Mattawa, Ont.—The contract for 2,700 ft. steel and concrete bridge was awarded to Stewart & Hewitson, of Port Arthur, Ont., $300,000.

BRIDGES.

CONTEMPLATED WORK.

Mobile, Ala.—Voted to issue $500,000 bonds for road and bridge construction.

Valdez, Alaska.—The Copper River Railroad Co. will begin at once to construct a bridge across the Kuskalina river.

Camden, Ark.—The county court has provided $40,000 for the construction of a steel bridge over the Ouachita river, at that place.

Clinton, Ark.—It is reported that a steel bridge across the north fork of Red river, at a cost of $6,000, is contemplated.

Oakland, Cal.—The board of supervisors will shortly ask for bids for the improvement of the Webster st. bridge. Estimated cost, $28,000.

Santa Ana, Cal.—The city clerk has been instructed to advertise for bids for the construction of a bridge on West Fifth st.

Stockton, Cal.—The Stockton Modesto Electric Railway will construct a steel bridge across the Stanilaus river.

Ripon, Cal.—The San Joaquin Valley Electric Ry. Co. will soon let contract for bridges over Stanilaus river.

Peoria, Ill.— About Dec. 1 bids will be received for the erection of a concrete and steel bridge. Estimated cost, $150,000.

Franklin, Ind.—Bids are being received for construction of a steel bridge at Monroe st. W. P. Jennings, audt.

Atchison, Kans.—A steel bridge on 13th st. is contemplated to cost about $5,000. C. T. Hawk, cy. clk.

Topeka, Kans.—The bridge plans of Co. Engr. V. R. Parkhurst were adopted by the co. commrs. and bids will be asked immediately, $126,000.

Harlan, Ky.—$15,000 has been appropriated for the construction of a steel bridge spanning Clover fork.

Escanaba, Mich.—A $40,000 bridge over Escanaba river at Wells is contemplated.

St. Paul, Minn.—Cy. Engr. Rundlett

Cleveland, O.—A petition is being signed by the citizens, asking for the con-

struction of a high level bridge across the Clark ave. route, to connect the East and West Sides of the city. Estimated to cost $1,000,000.
has prepared plans for a cement bridge over E. 7th and Earl sts., to cost about $35,000.

Yazoo City, Miss.—A bridge over Tehevals creek and over Bayou in Beat 4 and over Persimmon Bayou has been decided upon. Contracts will be let Nov. 7.

Jefferson City, Mo.—Plans are being pared for three concrete and steel bridges. C. A. Dierckx, co. clk.

St. Louis, Mo.—About Jan. 1 bids will be received on superstructure of bridge across Mississippi river.

St. Louis, Mo.—A viaduct over railroad tracks at Compton ave. is contemplated. To be concrete and steel and cost about $370,000.

Fairbury, Neb.—In January and February bids will be requested for the construction of a bridge.

Lincoln, Neb.—Concrete bridge at 1st and B sts. is contemplated. Roscoe Ozman, cy. clk.

Omaha, Neb.—The city council has decided to build a new viaduct on 11th st. to cost about $80,000.

Albany, N. Y.—State Engineer and Surveyor Williams approved plans, Oct. 15, for erecting a concrete bridge on the Burdick road.

Yorkville, N. Y.—Voted in favor of the proposition for constructing a sewer system, which will cost about $22,000.

Princeton, N. J.—Bids will be received for widening and repairing bridge over stream at Ewing st. Board of Freeholders.

Cincinnati, O.—Plans for a $300,000 viaduct have been prepared by Bridge Engr. Frank Morris.

Cleveland, O.—The county commissioners have directed Co. Engr. Landes to prepare plans for a 40-ft. bridge over Eddy brook in Branturhl township.

Portland, Ore.—Bids will be requested shortly for erection of the new Broadway bridge.

Bradford, Pa.—Voted Nov. 8 to issue $27,000 bonds for steel bridges across Tuna creek at Main and Mill sts., and for repaving Webster st. with vitrified brick.

Pittsburg, Pa.—Bonds to the amount of $1,975,000 have been voted for bridge construction.

Shippensburg, Pa.—Bids will be requested for construction of bridge over Main's Run.

Nashville, Tenn.—Bridge at Hyde Ferry, on the Cumberland river, will be repaired by Davidson co. commrs.; cost $33,000.

El Paso, Tex.—City Engineer Tood has completed plans for proposed viaducts east of city on Smelter road.

Richmond, Tex.—A bridge across Brazos river is contemplated, at a cost of about $30,000.

Richmond, Va.—Council has authorized st. com. to obtain plans and specifications for bridge to replace present Mayo's bridge. Estimated cost, $350,000, exclusive of site and approaches. Chas. E. Boling, cy. engr.

Aberdeen, Wash.—Bids will soon be ased for construction of a bridge at North Aberdeen.

North Yakima, Wash.—The construction of two new bridges, to cost $30,000, is contemplated.

Spokane, Wash.—Plans have been approved for a 6-arch concrete bridge over Hangman creek at cost of $425,000.

Tacoma, Wash.—The construction of a steel bridge at Eleventh st. and the Puyallup river has been decided upon. Bids will soon be requested.

Milwaukee, Wis.—The construction of a bridge spanning Milwaukee river at Wright st. is contemplated.

North Vancouver, B. C.—A bridge will be erected on the new road leading from car terminus to Rice Lake.

Frederickton, N. B.—Chief Commissioner Morrissy is calling for bids for reconstructing the McBride bridge, in Carleton conuty.

CONTRACTS TO BE LET.

San Diego, Cal.—Bids will be received on Dec. 6 for the construction of 5 bridges on the road between Oceanside and the Orange county line. Estimated cost, $27,000. Bd. of co. supvrs.

Perry, Ala.—Bids will be received on Dec. 5 for the construction of bridge across Econfenes river. John C. Calhoun, clk.

Norwalk, Conn.—Bids will be received on Dec. 20 for building reinforced concrete bridge. LeRoy Montgomery, sec., 51 Wall st., Norwalk, Conn.

Rock Island, Ill.—Bids will be received on Dec. 5 for the construction of a steel and reinforced concrete bridge, 158 ft. span, 16-ft. roadway, creosoted block deck and concrete floor and piers over Rock river. Wallace Treichler, cy. engr.

Vincennes, Ind.—Bids will be received on Jan. 5, for the construction of a bridge across White river. Co. commrs.

Shreveport, La.—Bids will be received on Dec. 8 for the construction of either a steel or wooden bridge in Ward 1 across Horseshoe Bayou, 1½ miles north of Belcher. A. L. Duringer, clk.

Virginia City, Mont.—Bids will be received on Dec. 7 for the construction of a proposed bridge over Madison river. Bd. of co. commrs.

Hastings, Neb.—Bids will be received on Dec. 31 for the annual bridge contract. Adams co. bd. of commrs.

Jefferson, O.—Bids will be received on Dec. 19, until 1 p. m. for a riveted steel Pratt truss bridge. Co. engr.

Courtland, Va.—Bids will be received on Nov. 29 for 9 steel bridges in Southampton county. Cy. clk.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for concrete arch bridge and dirt fill bridge over the Arroyo Seco at Pasadena ave. was awarded to Mercereau Bridge and Construction Co.; $118,750.

Modesto, Cal.—The contract for a concrete bridge across Ingram creek and El Puerto creek was awarded to Pacific Construction Co., 16 Califoruia st., San Francisco, $7,183.

Naples, Cal.—The contract for one highway and one railway bridge for Pacific Electric Ry. Co., and Huntington Land Co. was awarded to Peterson & Schmidt, 648 Pacific Electric Bldg., Los Angeles, Cal., $35,000.

Gardner, Ill.—The contract for the construction of a bridge was awarded to William H. Shons, Freeport, Ill., $6,000.

Marion, Ill.—The contract for a steel bridge was awarded to Decatur Bridge Co., $1,295.

Oregon, Ill.—The contract for rebuilding the floor of the Oregon bridge over Rock river was awarded to Bert Abbott, Oregon, Ill., $6,500.

Peoria, Ill.—The contract for the construction of a bridge near the Evans mill property was awarded to Joliet Bridge Co., Joliet, Ill., $1,674.

Bristol, Ind.—The contract for a new steel bridge over St. Joseph river at Bris-

tol, Ind., was awarded to Elkhart Iron & Bridge Co., $15,000.

Indianapolis, Ind.—The contract for 2 bridges, one at Dorman st. and the other at E. 10th st., to Hackedorn Construction Co., Indianapolis, Ind., $18,300.

Lafayette, Ind.—The contract for the construction of Gogin road was awarded to Snyder & Jenkins, Frankfort, Ind., $3,175.

Martinsville, Ind.—The contract for constructing two concrete arch bridges was awarded to E. O. Gilbert, city, $6,031.

Noblesville, Ind.—The contract for the erection of bridge between Marion and Hamilton counties was awarded to John W. Scott, Anderson, Ind., $4,844.

Petersburg, Ind.—The contract for repairing a bridge across the Patoka river was awarded to A. H. Kinman, $5,350.

Des Moines, Ia.—The contract for construction of a steel bridge was awarded to Iowa Bridge Co., Des Moines, Ia., $8,900.

Harlan, Ia.—The contract for steel bridges on Botna ditch was awarded to Iona Construction Co., Harlan, $10,750.

Iowa City, Ia.—The contract for the erection of a steel bridge was awarded to Iowa Bridge Co., Des Moines, Ia., $8,900.

Lonetree, Ia.—The contract for a bridge over Iowa river near Lonetree, Ia., was awarded to Iowa Bridge Co., Des Moines, Ia.

Owensboro, Ky.—The contract for the erection of 332-ft. steel leg bridge with concrete floor and wings, to Vincennes Bridge Co., Vincennes, Ind., $2,360.

Harlan, La.—The contract for construction of 5 bridges over Botna ditch was awarded to Lana Construction Co., $10,750.

Boston, Mass.—The contract to make improvements to pier No. 1, at the Boston navy yard was awarded to C. M. Leach, Boston, $26,673.

Hyde Park, Mass.—The contract for a reinforced concrete foot bridge was awarded to John Zechen, 935 Hyde Park ave., $1,345.

Sedalia, Mo.—The contract for construction of viaduct over railroad tracks in Washington ave. was awarded to Midland Bridge Co., Kansas City, Mo., $12,000.

Springfield, Mo.—The contract for construction of a 30-ft. concrete arch bridge was awarded to Canton Bridge Co., Canton, O., $6,848.

Missoula, Mont.—The contract for a bridge over Nine Mile creek was awarded to O. E. Peppard, Missoula, Mont., $2,880.

Albuquerque, N. Mex.—The contract for the proposed bridge across the Verde river was awarded to Missouri Valley Bridge and Iron Co., Leavenworth, Kans., $18,390.

Syracuse, N. Y.—The contract for the construction of Franklin st. bridge was awarded to Steel Storage & Elevator Construction Co., 730 Main st., Buffalo, N. Y., $38,245.

Yonkers, N. Y.—The contract for a bridge over Nepperhan river was awarded to Kearns & Hart, 280 Nepperhan ave., Yonkers, N. Y. $7,648.

Watertown, N. Y.—The contract for draw bridge at Chaumont was awarded to Sherzer Lift Bridge Co., Chicago, Ill., $7,490.

Celina, O.—The contract for a steel and concrete 125-ft. single span bridge to be constructed over Wabash river was awarded to William Ward, Celina. L. Marsh, co. engr.

Youngstown, O.—Contracts for the folowing were awarded: Bridge on Power road to J. Blim & Son, bridge over Dry run to L. K. Mauser, N. Walnut st., Youngstown, O.; 80-ft. span bridge, concrete or steel at east end of Park to L. K. Mauser, same address.

Nowata, O.—The contract for construction of 25 small bridges was awarded to Canton Bridge Co., Canton, O., $44,000.

Tulsa, Okla.—The contract for construction of steel bridge across the Arkansas river, near Bixby, Okla., was awarded to Canton Bridge Co., Canton, O., $68,970.

Plymouth, Pa.—The contract for Plymouth bridge was awarded to Penn Bridge Co., Beaver Falls, $276,973.

West Branch (Oxford Post Office), Pa.—The contract for removing the old bridge across the Chester river between West Branch and Crozerville and replacing it with a wooden, concrete, stone and iron structure was awarded to Chas. J. Pratt, Lima. The contract for concrete has been sublet to Joseph Rabb, Cheyney.

Wilkesbarre, Pa.—The contract for construction of Plymouth bridge was awarded to Penn Bridge Co., $276,973.

Petersburg, Va.—The contract for the superstructure of viaduct to be erected across the valley of Lieutenant Run was awarded to Roanoke Bridge & Iron Co., Richmond, Va., $40,000.

Seattle, Wash.—The contract for a bridge over Lake Union from Kilbourne st. and Sttone Way to Westlake ave. was awarded to Grant Smith & Co., $63,947.

Wheeling, W. Va.—The contract for repaving 17th st. was awarded to Independent Bridge Co.

Winnipeg, Man.—The contract for a bridge on the Pheasant Hills branch of Canadian Pacific Ry. was awarded to William Newman Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Cypress, Cal.—The city engineer is preparing plans for a disposal system.

Columbus, O.—Bids will be asked soon on a $17,000 garbage incinerating plant.

New York, N. Y.—Bids are requested Dec. 27, 12 m., for furnishing all labor and material for construction of the furnaces, steam boilers and appurtenances of the Clayton Destructor. George Cromwell, pres. of boro of Richmond.

Kansas City, Mo.—Two incinerating plants, to cost $50,000, are contemplated. J. E. Smyth, cy. clk.; J. E. Porter, mayor.

Seattle, Wash.—A complete collection and disposal system is under consideration. R. H. Thompson, cy. engr., is preparing plans. Bonds for $400,000 have been issued for the incinerator and $370,000 is available for the collection.

FIRE APPARATUS.

Lewiston, Me.—The purchase of an auto truck is being considered.

Vicksburg, Miss.—The purchase of an auto chemical wagon is contemplated.

Jamestown, N. Y.—Fire committee has recommended the expenditure of $30,000 for engines, combination chemical and hose wagon.

East Providence, R. I.—$5,000 has been appropriated for the purchase of motor driven, combination hose, and chemical truck.

Toronto, Ont.—Rudolph Hering has been retained to report on a garbage disposal system.